Spring 1987
Volume 31
Number 2

Mariners Weather Log

In this issue: "beyond the rainbow" -- a new column

RESCUE

Kenn Arbogast
U.S Coast Guard

During a ceremony honoring the Coast Guard rescue team in the White House Rose Garden, President Reagan called it, "One of the most dramatic rescue missions in the history of the Coast Guard."

WIDE WORLD

Soviet crew attends the Rose Garden Ceremony honoring the U.S. Coast Guard rescue crew. Transportation Secretary Elizabeth Dole looks on.

Three H-3 helicopters from Air Station Cape Cod battled sleet and gale force winds to pluck 37 Soviet sailors from the deck of a sinking freighter 220 miles off the New Jersey coastline March 14th.

Group Cape May received a distress call from 482-foot KOMSOMOLETS KIRGIZZII about 8:30 that morning. The ship's skipper reported his vessel had a 26 degree port list in heavy seas and requested immediate evacuation of his crew. The ship's list prevented the crew from lowering the lifeboats.

Third District operations center on Governors Island dispatched a C-130 from Air Station Elizabeth City to assess the situation. The Coast Guard Cutter TAMAROA, sailing up the New Jersey coast enroute to New Hampshire, was directed to the scene as well.

"We made it just in the nick of time," said LT Keith Comer, pilot of the first helicopter on the scene. "The entire port side was awash." The copter hovered 50 feet over the fantail of the sinking ship. Twenty-foot swells washed over the pilot house. Gusts of 55 knots howled through the ship's superstructure. "It took 15 minutes to find a place to drop the basket where it wouldn't snag, it was blowing around so in the wind," Comer said.

The first helicopter hoisted 15 people aboard in 20 minutes, then departed for Atlantic City International Airport, accompanied by the C-130 from Elizabeth City. A second C-130 remained on the scene. The second helicopter, with pilot Rick Hardy, an exchange pilot from the Canadian Forces, hauled up 16 more crewmen. The third copter picked up the remaining six crewmembers, including the skipper.

"By the time we got there, the ship had a 40- degree list," said AD3 Mark Noonan, hoist operator on the third copter. "It was a pretty tough hoist job, because of all the obstructions on deck and the wind knocking the basket around."

The last helicopter arrived in Atlantic City at 2:35 pm. Each one was in the air about 4 hours and travelled more than 400 miles on the mission. LTJG Matthew Thomas, a co-pilot, talked with the rescued Soviet captain. The skipper told Thomas his ship's engines stopped and the vessel turned broadside in 30-foot waves. The load of flour sacks shifted to one side and caused the ship to list, Thomas said.

The KOMSOMOLETS KIRGIZZII was barely afloat when the TAMAROA arrived late Saturday night. According to the TAMAROA's executive officer, LCDR Kenneth Dykstra, "The freighter was laying over, about 90 degrees. With 18-foot swells, it was apparent that it was going down." TAMAROA moved away to wait for the first light. At dawn there was no freighter afloat. "All that was left was thousands and thousands of bags of flour," Dykstra said. "Except for an oil slick, all the water was white."

The rescued Soviets stayed in New Jersey the night of March 14th and flew to a Soviet embassy compound the next day. The rescued and rescuers were reunited three days later in Washington. President Reagan invited the Soviet crew to attend an awards ceremony at the White House. The pilots, co-pilots and flight mechanics on each crew received Air Medals and other crewmembers received Coast Guard Commendation Medals.

In praising the crews for the daring efforts, Reagan said, "In your courage, your tenacity, your know-how, you summed up all that is best in the American spirit -- in a word, all that is heroic."

Mariners Weather Log

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FEATURES

DEPARTMENTS

MARINE WEATHER REVIEW

Cover: *The U.S. Coast Guard comes to the aid of the KOMSOMOLETS KIRGIZZII* (U.S. Coast Guard Photo).

Back cover: *One wish of the Russian crew was to eat at, guess where?* (Wide World Photo).

MEN WHO MOVE MOUNTAINS -OF ICE

They tow icebergs by Jerry LeBlanc

"Iceberg dead ahead," came the report from the radar observation deck of the red-hulled *Seaforth Jarl*, a two-hundred foot steel vessel with a strange, double-tower configuration, its entire white superstructure sitting forward like a tugboat.

They sailed the choppy waters of the Labrador Sea which had earned the nickname "Iceberg Alley" because every June, when the solid winter ice pack melts, hundreds of icebergs are turned loose and head south, menacing everything in their way.

On the bridge of the ship, the captain carefully noted the iceberg's bearing, speed and direction. He ordered a collision course, heading straight for it into the wind. Wearing hooded foul weather gear, he hugged himself for warmth as an 18-knot wind blasted at him from the white mountain of ice dead ahead. "Damn thing could weigh 10 million tons," he said to a young man who hurriedly joined him on the bridge, Neil Riggs, a mechanical engineer specializing in ice fluid dynamics. For the next few hours, Riggs would be practically in charge of the ship, much like a bombardier taking over an aircraft at the

The stern deck area of the SEAFORTH JARL.

critical point of a mission.

The mission of the SEAFORTH JARL was something new and untried. With a hundred tons of pulling power, they would attempt to tow an iceberg out of harm's way. Riggs, a scientist employed by the Newfoundland Ocean Research and Development Corporation (NORDCO), had devised the technique.

Visually they inspected the monster that dominated their horizon. It was shaped like the craggy peak of an Alp, with most of its body submerged. A mile from the berg, crewmen on the flat, low-lying afterdecks dropped a globular marker-buoy and began paying out a white, 4 - inch floating rope from a giant winch amidships. Following Riggs' instructions, the tow vessel veered to starboard, skirted the iceberg, turned hard aport completely encircling it with a noose and then made the return run to the marker-buoy with extreme care so as not to cross their towline.

Having recovered the marker-buoy, crewmen attached a 100-ton shackle and began to lay a single stretch of steel cable 400 meters long. The heavier steel cable would hold the lighter rope noose low in the water, acting like a sinker on a trolling line, giving good leverage.

Once the cable was rigged to the towing winch on the ship all personnel were ordered to

This fantastic iceberg was sighted by the U.S. Coast Guard Cutter EASTWIND on a resupply mission. U.S. COAST GUARD

clear the decks. The tug of war had begun.
Tension from the ship's 9,000 horsepower engine was increased to 5 tons, as a starter, to check the stability of the iceberg and the towing connections. If the berg toppled or broke under high tension, or the rope slipped, the entire towline could snap back a the ship like a giant fly swatter. Gradually tension was increased. The engine roared and an immense backwash kicked up behind the ship, its aft end dipping with the strain. At 65 tons of tension, the iceberg began to move. Cheers sounded from the crew. Man was moving a mountain!

Every summer this scene is repeated a hundred times or more in Labrador Sea as rugged workboats struggle to clear the waters of the deadly iceberg threat, so that a multi-billion dollar oil and gas exploration venture can proceed with reasonable safety.

This applied technology is part of a relatively new science called Ice Management. St John's, Newfoundland, located at the frontier of the frozen north, rapidly is becoming one of the world centers for research and development in this speciality.

Among the research facilities in St. John's is the world's largest hydraulic tank for testing ice properties, at the Marine Sciences Research Laboratory, Memorial Universtiy, which also houses the Centre for Cold Ocean Resources Engineering. They are doing pioneering work in the problems of resource development in ice-bound environments.

The iceberg towing technique developed at NORDCO, a private corporation employed by the national energy organization, Petro-Canada, was born out of necessity in the wake of a violent near-disaster about 10 years ago.

Petro-Canada had just begun optimistic drilling operations in the Labrador Sea, a challenging venture restricted to the summer months when the waters are open to navigation. The drill ship TYPHOON took up its place, a fixed position chosen by petroleum geologists. Its derrick sent drilling pipe down through the floor of the ocean.

An iceberg loomed out of nowhere and bore down relentlessly on the stationary TYPHOON, towering above the ship as currents carried the frozen mountain on a direct-hit course. With ice splattering on the decks, the call went out, "Abandon ship!"

Luckily, no lives were lost and the iceberg did no major damage. Petro-Canada felt that this near miss could have resulted in the death of all onboard the TYPHOON, a multi-million dollar oil spill and the serious political ramifications caused by such a disaster in this virgin territory. Thus they began investigating means of preventing possible future collisions.

At the time, few scientists in the world knew much about icebergs, and even fewer knew the practical care and handling of icebergs.

Riggs was an exception. While at Memorial University, he had carried out an experimental project, in which he took over an abandoned American DEW line outpost (Distant Early Warning System) on a seaside cliff on the Labrador Coast, to monitor the traffic in icebergs by plotting their drift paths to determine what influences their course.

"Cheers sounded from the crew. Man was moving a mountain!"

The SEAFORTH JARL with an iceberg under tow.

That cold-ocean research led to further investigations of icebergs. Riggs studied the entire limited body of scientific literature on the subject and became intrigued by a technique initiated by a British company called Marex. For a time, they attempted to tow icebergs in the Hudson Bay area, later abandoning the work.

With the backing of NORDCO, Riggs slowly, and largely by trial and error, charted a procedure for iceberg towing that -- if it worked-- would contribute to the chances of Petro-Canada's success in their bonanza-scale oil and gas discoveries in frigid waters.

The system today operates with a far-flung network that uses everything from sophisticated satellites to igloo-style instrument camps in the far north. Most of the snow-bound weather stations have been automated by now. Their input is vital because the drilling operations are so limited that the loss of a single day could cost millions.

When the satellites and weather stations report the beginning of the break-up of the ice pack, usually in early June, patrol planes are sent out on a coastal route from Newfoundland to Labrador for a fog-bound, difficult visual inspection, which is repeated daily until the signs indicate it is safe for the drill ships to move in.

Winds and currents are monitored, berg count begins. Drillships set sail and, when they reach their destination, sink their equipment.

Each drill ship maintains an observation deck around the clock, using computers programmed for iceberg drift patterns as well as radar and visual sightings. A danger-zone is established around each drill rig and every iceberg is assigned a number. Its position, range, bearing and measurements are logged.

Often a single drill rig will be monitoring more than 50 icebergs at a time. Each iceberg is tracked to determine where it is going, and the currents-- which bear on the major, invisible underwater portion of the iceberg--vary so much from mile to mile that tracking charts sometimes look like a pattern of zig-zags. "It's an art as much as a science," said Greg Warbanski, an executive with Petro-Canada. "When a new iceberg comes in, our observer has got to have a feel for where it will go. They are experts who know iceberg age, shapes and danger."

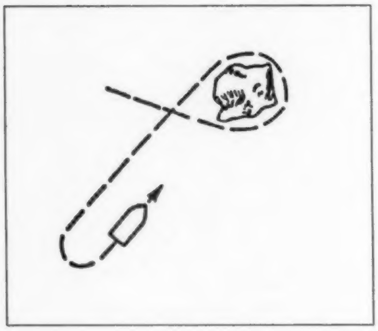
A full range of classifications for every iceberg has been established and each is assigned a code which an expert can translate into facts. The classification sets up a scale that takes into consideration the development stage or age of the ice, the concentration of the thickest types, the predominant form, and the size among other characteristics.

"Each drill ship is guarded by one vessel that is rigged for full-time towing and a second ship on stand-by," Warbanski said. "Some of the tow vessels are equipped with side-scan radar to measure the shape of the berg underwater. An accumulation of this data is fed into the computers trying to establish a drift model."

An experienced captain sails around his quarry to inspect its potential for stability and the difficulty of towing. The smoothness of the exterior, the shape, even the hardness of the ice are factors which can make the iceberg perilous.

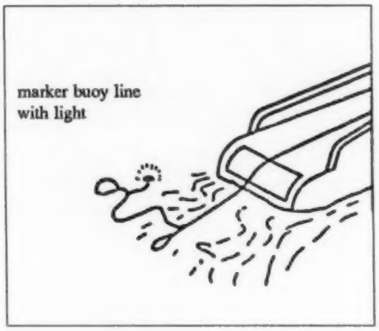
The SEAFORTH JARL is a specially equipped supply vessel.

TOWING PROCEDURE



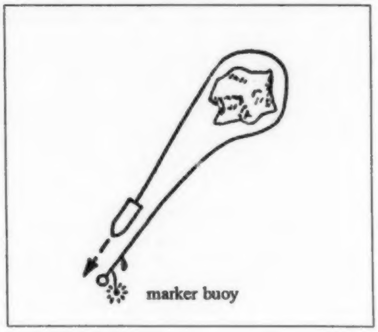
Step 1.

1. Boat inspects berg and starts approach on tow bearing 1 mile from berg.



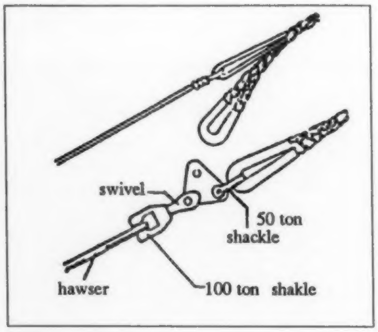
Step 2.

1. Marker buoy line (with light if required) attached to handling loop on end of towline
2. Place marker buoy in water.
3. Begin towline payout.



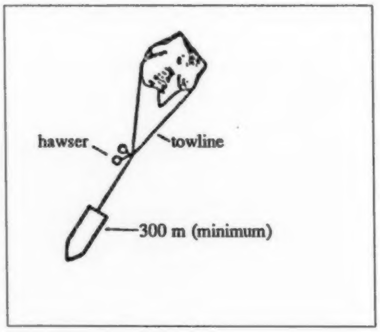
Step 3.

1. Boat proceeds to berg with towline completely out, circles berg and returns to marker buoy.
3. Stay lines attached to hawser.



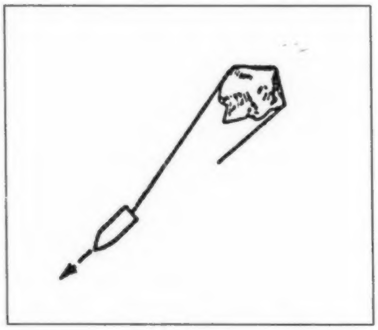
Step 4.

1. Marker buoy recovered and both ends of towline shackled to swivel on towing hawser.
2. Floatation buoys attached to swivel.
3. Stay lines attached to hawser.



Step 5.

1. Hawser payed out to minimum of 300 m. Additional payout based on sea state and proximity of berg to boat wake.
2. Personnel keep clear of work deck.
3. Increase line tension to 5 tons to check berg stability and towline connection on berg.
4. Slowly increase power until operational tension reached.



Step 6.

1. Upon order to terminate stop boat.
2. Disconnect one end of towline from hawser.
3. Remove twists from towline.
4. Slowly pull clear of berg.
5. Recover towline.
6. Inspect and repair towline as required during recovery.

"There can be many dangers," Warbanski said "They work in fog and stormy seas. If the iceberg tips or rolls, letting go the towline, all the ship can do is cut the line and run, hoping to out distance the elastic-band recoil that will come at it. "If you cross your towline during these operations, you're tied to the iceberg and could lose your whole ship," Warbanski said, "and if your towline fouls in the ship's propellers, the plastic-type rope melts under the heat of contact. If that happens, you need divers to get free."

The tow vessels are equipped with a tension meter which sends the towlines through an adjustment of wheels that measure tons of pressure, so that they can keep track of how much power they are using and adapt to the circumstances.

In the present stage of the technique, the shape of the iceberg is the crucial factor. "If you know the shape, you can tell the danger," Warbanski said, adding, "We're changing and adapting."

The number one priority in the development and use of the technique is protection of the drill ship. "Beyond that," Warbanski said, "If we're going to work in this environment, we've got to learn as much about it as possible."

Once an iceberg is taken under tow, it is hauled from 5 to 15 miles away, where known currents will carry it on a path that will not endanger the fixed-position drilling ships.

As for other shipping that might be endangered, one expert commented, "You still hear of cargo ships hitting icebergs occasionally, but its almost always an inexperienced skipper--someone who's never sailed ice waters before -or there's some breakdown involved. Otherwise, ships have the capability, the maneuverability to avoid such collisions."

Icebergs are so commonplace in the Newfoundland-Labrador area that, during the summer when they parade by within sight of St. John's and other coastal cities few heads turn except to marvel at the beauty of the invading monsters. If they reach the Gulf Stream, which runs east of the island province, its warmth can swiftly turn them back into water, sometimes within a day. The towing technique is constantly being refined and a great body of data on iceberg characteristics is being built up that will contribute to improvements in the project.

Riggs said, "I'd like to see a reliable method developed for predicting the path of an iceberg through wind, atmosphere and current--all the elements that affect its movement."

In the interest of achieving this, Riggs is trying to organize a permanent experimental station in the waters off Newfoundland, which would use large-scale models of drilling ships and other vessels and match them with floating ice fragments that compare, by ratio, to the size of the icebergs.

"Such an installation, using current meters and other instruments to make precise measurements on shape and motion characteristics, could make a major contribution to Ice Management," Riggs said.

"You have to learn as much as you can about your environmental dangers if you're going to live with them," Riggs added, "especially when you're dealing with deadly icebergs."

This story was originally published in a 1986 issue of Compass.

EASTERN NORTH PACIFIC TROPICAL CYCLONES OF 1986

— by E.B. Gunther and R.L. Cross
Eastern Pacific Hurricane Center
NOAA, National Weather Service

The 1986 eastern North Pacific tropical cyclone season began on the 22d of May with the formation of tropical storm Agatha and ended on the 25th of October with the dissipation of tropical depression 25-E. There were 25 tropical cyclones during the 1986 season, 17 of which were named. This was only one fewer than the record 26 storms in the 1982 season. The monthly distribution of 1986 tropical cyclone activity is shown in table 1 and 2; table 3 compares this activity with that of recent years.

Three of the eastern North Pacific tropical cyclones moved onshore during the 1986 season, compared to only one the year before. Hurricane Newton moved onshore with 65-knots winds, near Punta Rosa, Mexico. No reports of damage were received. Hurricane Paine hit the Mexican mainland near San Jose (Boca del Rio) with winds of 80 knots. Hurricane Roslyn hit Mazatlan with 65-knot winds. There was some damage from wind and flooding, however no injuries were reported.

While satellite imagery is one of the most important tools used by tropical forecasters, aircraft reconnaissance and surface ship reports retain their importance as invaluable comparative observations.

Only hurricanes will be described but tracks show both hurricane and tropical storms for the Eastern and Central North Pacific (figures 1 and 2).

Table 1. -- Monthly distribution of 1986 storms.

EASTERN NORTH PACIFIC TROPICAL CYCLONES 1986

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot
Tropical Depressions	1	0	3	1	2	1	0	0	8
Tropical Storms	0	1	1	4	2	0	0	0	8
Hurricanes	1	1	2	1	3	1	0	0	9
Total	2	2	6	6	7	2	0	0	25

Tropical Cyclones are ascribed to the month in which they began.

Hurricane Agatha

May 22-29

The eastern Pacific tropical cyclone season began with a small disturbance 750 miles south of the tip of Baja California on the 20th. Turning northeastward under strong southwesterly flow aloft, the disturbance intensified slowly over 28°-C water. By 0000, cyclonic curvature was evident about the center and the disturbance was upgraded to a tropical depression. The cyclone then turned southeastward under the northeast side of a newly formed upper level high centered 300 miles to the southwest. Forty-eight hours later the cyclone turned westward and 6 hours later was upgraded to tropical storm Agatha. The cyclone then made another abrupt change in direction accelerating rapidly toward the north northeast.

Moving toward slightly warmer 29°-C water, winds around the center of Agatha increased to their maximum of 65 knots by 0000 on the 26th and the

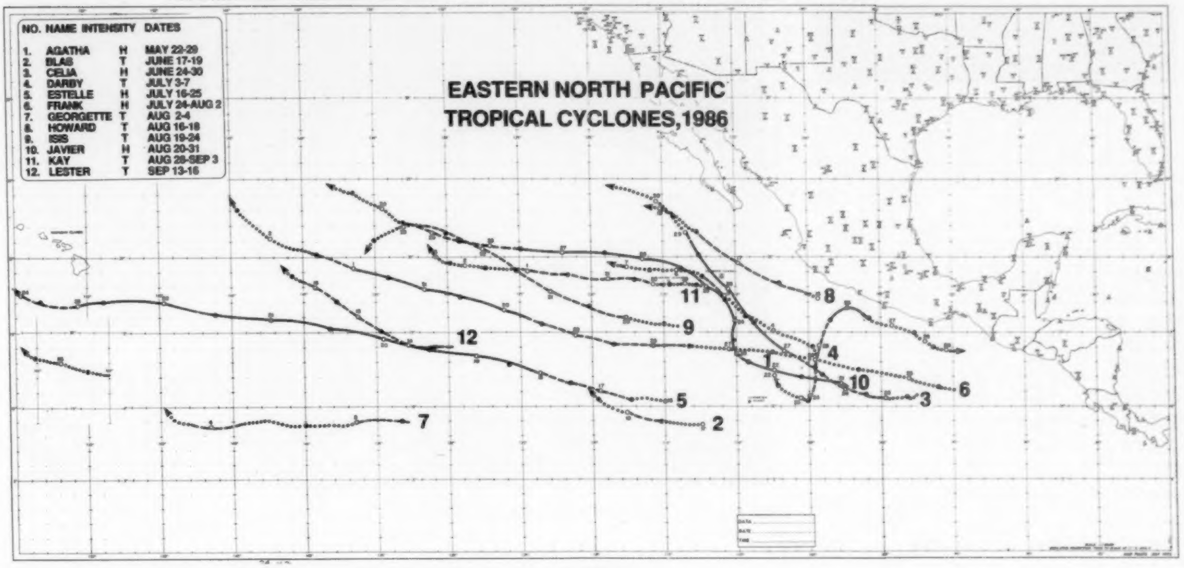


Figure 1. -- Eastern and Central North Pacific tropical cyclones, 1986.

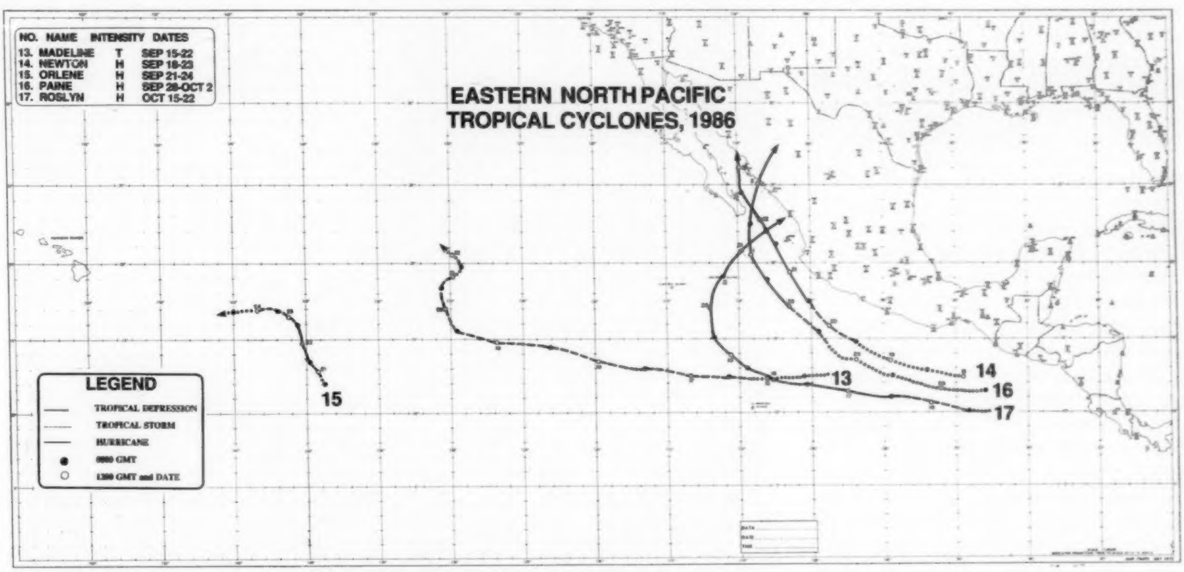


Figure 2. -- Eastern and Central North Pacific tropical cyclones, 1986

storm was upgraded to a hurricane (figure 3). By now a trough over the Baja California Peninsula had weakened and the hurricane began to turn under the influence of an upper level high. Winds continued at 65 knots for 12 hours, then began to weaken as the sea surface cooled slightly and the storm headed down the Mexican coast, 60 miles offshore. By 1200 on the 27th winds were down to 30 knots and the storm was downgraded to a depression, 80 miles south southeast of Acapulco. Except for a brief intensification between 0000 and 1200 on the 28th, the cyclone continued to weaken and finally dissipated 130 miles south of Salina Cruz at 1800 on the 29th.

Weather observations from the B.T. ALASKA, EXXON WASHINGTON, AMERICAN MERCHANT, OPPMA MARU and the NISSAN SILVIA were very helpful in locating the center of Agatha.

Hurricane Celia

June 24-30

Five days after the demise of tropical storm Blas, the next cyclone of the season was beginning to develop 300 miles south of the Gulf of Tehuantepec. By 1800 on the 24th a cyclonic circulation was evident. Winds increased to 35 knots by 0000 on the 26th and the depression was upgraded to tropical storm Celia, 375 miles south of Acapulco. Accelerating to 14 knots, the cyclone reached hurricane intensity by 1800 on the 27th. A well-developed eye could now be seen near the center on visible satellite imagery (figure 4). Celia then turned northwestward. Six hours later the cyclone reached its maximum intensity of 75 knots. Accelerating to 16 knots Celia passed about 8 miles west of Socorro Island at 1600 on the 28th. Slowing to 8 knots, Celia was downgraded to a tropical storm at 1200 on the 29th, 215 miles west southwest of the tip of Baja California. Twelve hours later the cyclone was downgraded to a tropical depression over 21°-C water. Weather observations from the KEYSTONER, EXXONN BENICIA, THOMPSON PASS, and the VERRAZANO BRIDGE, were helpful in tracking Celia during the latter half of the cyclone's life.

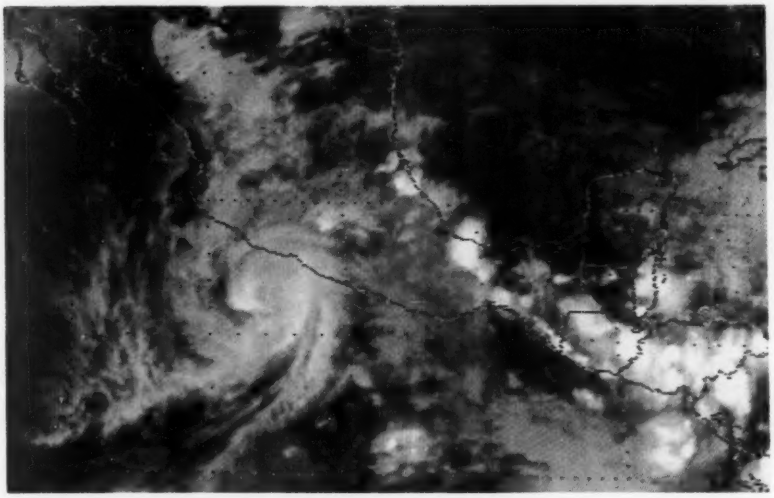


Figure 3. -- Hurricane Agatha on the 26th, south of Manzanillo.

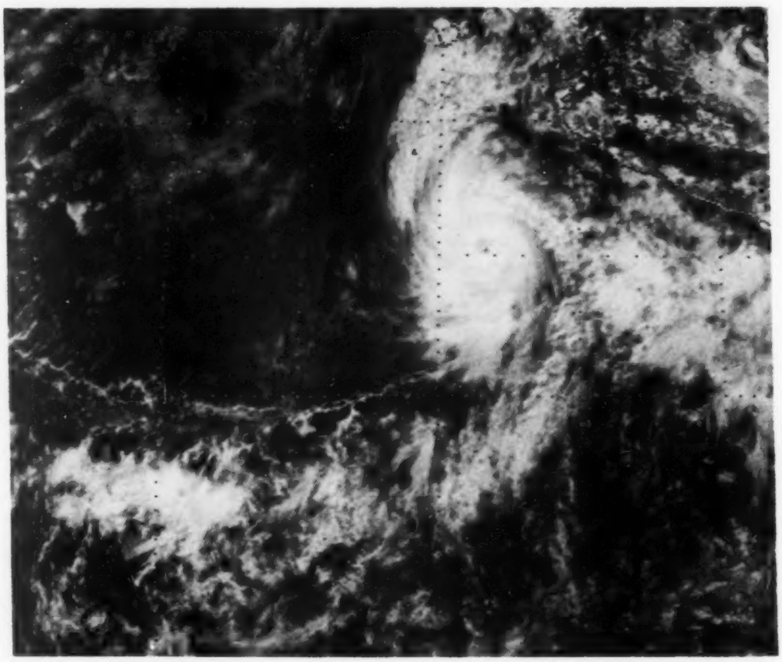


Figure 4. -- Hurricane Celia with winds approaching maximum intensity of 75 knots on the 27th.

Hurricane Estelle

July 16-21

Satellite imagery and weather reports from the cargo ships HAMBURG EXPRESS and ALEKSANDER VERMISHEV confirmed the next cyclone of the season, 340 miles west of Clipperton Island at 1200 on the 16th. Moving westward beneath the south side of an upper level high, the cyclone intensified rapidly over 28°-C water and was upgraded to tropical storm Estelle 12 hours later. The storm was upgraded to a hurricane at 1200 on the 18th. Twelve hours later satellite imagery began

Table 2. -- Summary of the season.

EASTERN NORTH PACIFIC TROPICAL CYCLONES 1986				
NO.	NAME	CLASS	DATES	MAX. WIND (KNOTS)
1.	Agatha	H	May 22-29	65
2.	TD2	Td	May 31-Jun 1	25
3.	Blas	T	Jun 17-19	35
4.	Celia	H	Jun 24-30	75
5.	Darby	T	Jul 3-7	35
6.	Estelle	H	Jul 16-21	115
7.	TD7	Td	Jul 17-18	25
8.	TD8	Td	Jul 21-24	30
9.	Frank	H	Jul 24-Aug 2	75
10.	TD10	Td	Jul 27-29	25
11.	Georgette	T	Aug 2-4	35
12.	TD12	Td	Aug 4-14	30
13.	Howard	T	Aug 16-18	35
14.	Isis	T	Aug 19-24	45
15.	Javier	H	Aug 20-31	115
16.	Kay	T	Aug 28-Sep 3	40
17.	TD17	Td	Sep 8-9	25
18.	Lester	T	Sep 13-16	45
19.	Madeline	T	Sep 15-22	60
20.	Newton	H	Sep 18-23	75
21.	TD21	Td	Sep 19	30
22.	Orlene	H	Sep 21-22	65
23	Paine	H	Sep 28-Oct 2	80
24.	Roslyn	H	Oct 15-22	125
25.	TD25	Td	Oct 24-25	30

to show an eye developing near the center. Accelerating to 17 knots, Estelle reached its maximum intensity of 115 knots by 1200 on the 20th. It then began to turn westward (figure 5). Accelerating to 20 knots, it crossed into CPHC's area of forecast responsibility with 115-knot winds at 0500 on the 21st.

Hurricane Frank

July 24-August 2

The next cyclone began as a tropical disturbance 170 miles south southwest of San Salvador at 1800 on the 23d. Moving westward at 12 knots, the disturbance was upgraded 24 hours later, 300 miles south of Salina Cruz on the Gulf of Tehuantepec. Weather reports from the ATIGUN PASS and cargo ship FUHWO VENTURE were helpful, in locating the center at this time. By 0600 on the 28th, winds near the center had increased to 35 knots and the depression was upgraded to tropical storm Frank. By 0600 on the 30th winds had reached 65 knots and the storm was upgraded to a hurricane. A well developed eye appeared in satellite imagery by 0900 on the 31st, and three hours later the cyclone reached its maximum intensity of 75 knots (figure 6). Frank continued at maximum intensity for 18 hours, then began to weaken rapidly over colder 25°-C water. Low clouds to the north and west began to enter into the cyclonic circulation further weakening the storm. Within 24 hours winds near the center were down to 30 knots.

Weather reports from the OTRADNOE, JINMEI MARU, HO CHI MINH, and the CHIYODA MARU NO. 2 were helpful in locating the center and intensity of Frank.

Hurricane Javier

August 20-31

Hurricane Javier began as a tropical disturbance 400 miles south of the Gulf of Tehuantepec on the 19th. Moving westward the disturbance began to show cyclonic circulation by 1200 on the 20th and became a tropical depression. Six hours later the depression was upgraded to tropical storm Javier. Turning west north westward the cyclone intensified rapidly, and became a hurricane at 0900 on the 21st. Javier continued at 15 knots for another six hours, then began to slow. The hurricane then turned sharply toward the north and at 1200 on the 24th reached its maximum intensitv of 115 knots Powerful hurricane Javier passed midway between Socorro and Clarion

Figure 5. -- Hurricane Estelle generating 115-knot winds on the 21st.

Islands at 1900, then turned west northwestward. The cyclone began weaken over 26°-C water. Low level clouds to the west began to enter into the cyclonic circulation, further weakening Javier. By

Figure 6. -- South of the Baja, Javier generates 115-knot winds on the 25th.

1200 on the 28th, winds were down to 60 knots and the cyclone was downgraded to a tropical storm.

The colder water and the shearing action of the upper level trough began to weaken the storm even more rapidly. By 0600 on the 30th, winds were down to tropical depression strength.

Weather observations from the NOAA research ship DAVID STARR JORDAN, the cargo ships SCANDINAVIAN HIGHWAY, STAR PHILIPPINES, KAURI and the Russian ship VYSOKOGORSK were all helpful in locating the center and intensity of Javier.

Hurricane Newton

September 18-23

Hurricane Newton began as a tropical disturbance, which passed into the Pacific through Nicaragua. Moving west-northwestward over 29°-C water, this disturbance was classified a tropical depression Twenty at 1200 on the 18th, 240 miles south of Salina Cruz, Mexico. With slow but steady intensification, the depression was named tropical storm Newton at 0000 on the 20th. Newton moved on a path nearly parallel to the Mexican coast, reaching hurricane strength at 0600 on the 21st, 200 miles southwest of Guadalajara.

Newton tracked northwestward as a minimal hurricane. A NOAA reconnaissance aircraft made low level passes through the hurricane beginning at 1800 on the 21st and found maximum sustained surface winds of 65 to 70 knots. Sea level pressure extrapolated from the 900-millibar level was found to be 984 millibars. At 1800 on the 22d, Newton passed within 25 miles of Cape Pulmo, which lies to the northeast of Cabo San Lucas (figure 7). The storm then turned northward and moved inland near Punta Rosa, located southwest of Navojoa. No reports of damage were received with this hurricane.

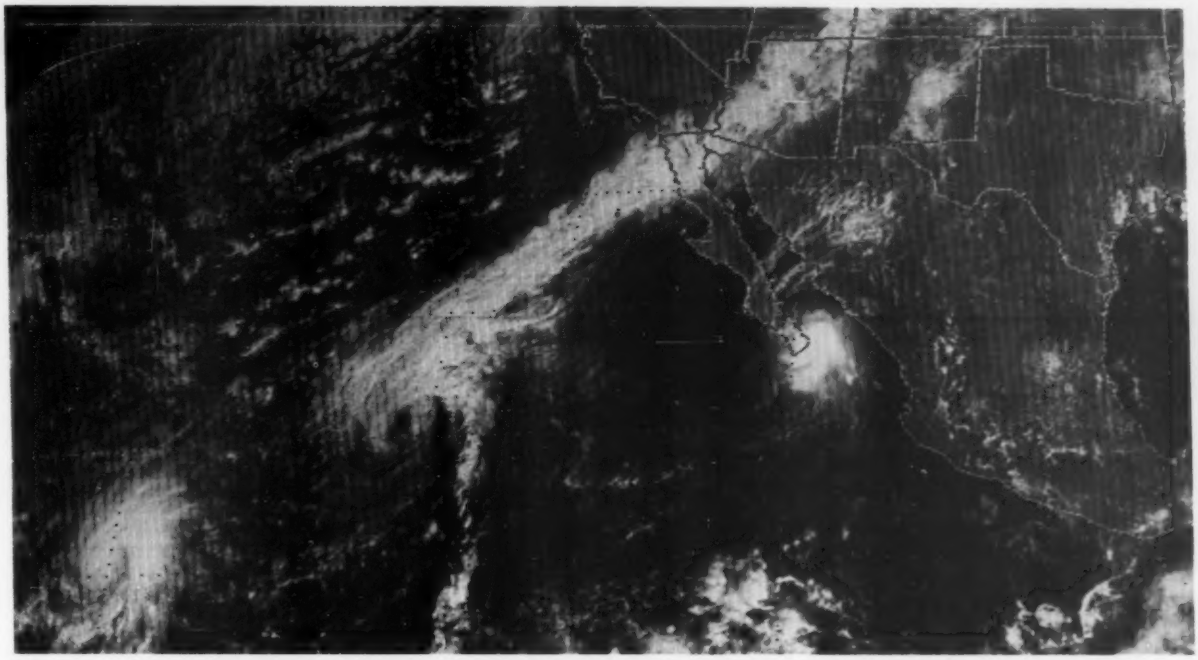


Figure 7. -- Newton hits the Gulf of California with tropical storm Madeline and hurricane Orlene in the distance, on the 22d.

Hurricane Orlene

September 21-22

Hurricane Orlene originated as a disturbance in the Intertropical Convergence Zone near 10°N , 38°W on the 19th.

The deep layer mean ridge extended from southern Baja California to the Hawaiian Islands and a well developed upper level trough was situated to the north.

Water temperatures in this area were about 29°C. The disturbance remained quasi-stationary for about 30 hours, then began to move northwestward. It was classified as a tropical depression at 0000 on the 21st. With explosive intensification, it was upgraded to tropical storm Orlene at 1200, and to Hurricane Orlene at 2100.

At 0000 on the 22d Orlene became the responsibility of the CPHC in Honolulu (figure 8).

Figure 8. -- Orlene moves across 140 degrees and into the Central Pacific on the 21st.

Hurricane Paine

September 28 - October 2

The twenty-third tropical cyclone of the season passed into the Pacific Ocean through Central America on the 27th. Moving westward this disturbance was classified as a tropical depression at 0000 on the 28th, 225 miles southwest of Guatemala City. The KOYO MARU was especially helpful in analyzing the wind field around the tropical depression in its early stages.

Turning northwestward on a track parallel to the coast, the depression was named tropical storm Paine at 0000 on the 30th, 300 miles west southwest of ACAPULCO. At 2100, a NOAA reconnaissance plane observed maximum low level winds of 72 knots. On the basis of this report,

Paine was upgraded to a hurricane at 0000 on the 1st. About this time, the DAIRYU MARU and FUJI MARU sent observations while within 75 miles of Paine. Paine reached maximum intensity of 85 knots at 0000 on the 2d when centered 50 miles east southeast of Cabo San Lucas.

Hurricane Paine then turned north northeastward and accelerated, hitting the coast near San Jose (Boca del Rio) with winds near 80 knots estimated (figure 9). No reports of damage were received from that area. Paine moved rapidly across Mexico into Texas, where it added significant amounts of rain into an area from west Texas across Oklahoma and southeast Kansas into the middle Mississippi Valley. Flooding was reported, as this area had already been drenched by heavy rainfall from previous storms (figure 10). In addition to the vessels mentioned above, the following ships also sent very useful observations: MOBIL ARCTIC, SERGEY YESENIN, SUN PRINCESS, and AKAMA MARU.

Hurricane Roslyn

October 15-22

Roslyn originated as a tropical disturbance which moved westward over the warm waters west of Nicaragua. At 1800 on the 15th, satellite imagery showed increasing cyclonic organization. At the same time the car carrier SATURN DIAMOND was located about 100 miles to the northwest and was experiencing easterly winds. The first bulletin was issued at that time. Tropical depression twenty-four moved west northwestward at 12 knots. Rapid intensification followed, with the depression being upgraded to tropical storm Roslyn at 0600 on the 16th. Twenty-four hours later Roslyn reached hurricane strength.

An eye became visible at 1800 on the 17th with winds estimated at 85 knots. Roslyn continued moving west northwestward and, over the warm 30°-C waters southwest of Acapulco, wind speeds increased to 125 knots by 0600 on the 19th. Roslyn turned toward the northwest that same day then northward, with winds of 115 knots. Between 1200 and 1800 on the 20th, maximum winds decreased to about 75 knots. Roslyn hit the Mexican mainland, at Mazatlan, with 65-knot winds. There were no injuries reported, due in part to the excellent preparation made by Mazatlan officials before Roslyn arrived. More than two thousand people were evacuated from coastal areas and shipping interests were advised to move all vessels to a safer area. Damage was limited mainly to flooded homes and factories, some crops and one yacht which was sunk. No serious damage to the fishing fleet was reported. The remnants of Roslyn continued into the southwestern parts of the United States and caused some of the most severe flooding of the 20th Century in parts of Oklahoma, already hard hit by flooding from hurricane Paine.

The following ships sent useful observations while in the vicinty of hurricane Roslyn: SATURN DIAMONG, RUTH LYKES, NOAA ship DAVID STARR JORDAN, EXXON BOSTON, and the PACIFIC PRINCESS.

Figure 9. -- Paine skirts just east of Cabo San Lucas on the 20th.

Figure 10. -- The rain from Paine falls mainly on the plain, near Oklahoma City (right).

(U.S. Corps of Engineers photo).

Table 3. -- Frequency of storms.

EASTERN NORTH PACIFIC TROPICAL CYCLONES

Year	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot
1966	0(0)	1(1)	0(0)	4(4)	6(2)	2(0)	0(0)	0(0)	13 (7)
1967	0(0)	3(1)	4(0)	4(2)	3(1)	3(2)	0(0)	0(0)	17 (6)
1968	0(0)	1(0)	4(0)	8(3)	3(2)	3(1)	0(0)	0(0)	19 (6)
1969	0(0)	0(0)	3(1)	2(1)	4(1)	1(1)	0(0)	0(0)	10 (4)
1970	1(1)	3(0)	6(1)	4(1)	1(0)	2(1)	1(0)	0(0)	18 (4)
1971	1(1)	1(1)	7(5)	4(2)	2(2)	2(1)	1(0)	0(0)	18 (12)
1972	1(1)	0(0)	1(0)	6(6)	2(1)	1(0)	1(0)	0(0)	12 (8)
1973	0(0)	3(1)	4(3)	1(0)	3(2)	1(1)	0(0)	0(0)	12 (7)
1974	1(0)	3(2)	3(2)	6(4)	2(2)	2(1)	0(0)	0(0)	17 (11)
1975	0(0)	2(1)	4(2)	5(3)	3(1)	1(1)	1(0)	0(0)	16 (8)
1976	0(0)	2(2)	4(1)	4(2)	3(3)	1(0)	0(0)	0(0)	14 (8)
1977	1(0)	1(0)	1(1)	1(1)	1(1)	1(1)	0(0)	0(0)	8 (4)
1978	1(1)	3(2)	4(3)	6(4)	2(1)	2(1)	0(0)	0(0)	18 (12)
1979	0(0)	2(1)	2(1)	2(2)	1(1)	2(1)	1(0)	0(0)	10 (6)
1980	0(0)	3(2)	5(2)	2(2)	2(1)	2(0)	0(0)	0(0)	14 (7)
1981	1(0)	1(1)	3(1)	4(3)	2(1)	4(2)	0(0)	0(0)	15 (8)
1982	1(0)	1(0)	6(4)	5(3)	4(3)	2(1)	0(0)	0(0)	19 (11)
1983	1(1)	1(1)	6(2)	3(2)	5(3)	3(2)	1(0)	1(1)	21 (12)
1984	2(1)	3(3)	3(2)	4(2)	4(4)	2(0)	0(0)	0(0)	18 (12)
1985	0(0)	5(2)	7(1)	4(3)	4(3)	2(2)	0(0)	0(0)	22 (11)
1986	1(1)	2(1)	3(2)	5(1)	5(3)	1(1)	0(0)	0(0)	17 (9)
Tot	12(7)	41(21)	80(34)	84(51)	64(38)	40(20)	6(0)	1(0)	328(173)
Avg	0.6(0.3)	2.0(1.0)	3.8(1.6)	4.0(2.4)	3.0(1.8)	1.9(1.0)	0.3(0)	.05(0)	15.6(8.2)

Figures in parentheses represent tropical cyclones that have reached hurricane intensity. Tropical cyclones are ascribed to the month in which they began.

Emil Gunther, coauthor of this summary, has recently retired from the National Weather Service. He came to the San Francisco office in the late 1960's and has been writing the hurricane summary since 1976. Emil's wife retired at the same time and they have moved to a new home in Novato, a small community just north of the Golden Gate Bridge. In addition to working on the new house, he is also enjoying plenty of sailing and bicycling. We would like to wish both Emil and his wife a happy retirement.

Estelle (left) and Orlene (bottom) were the only hurricanes to cross the Central Pacific region this season.

CENTRAL NORTH PACIFIC TROPICAL CYCLONES, 1986

Central Pacific Hurricane Center
National Weather Service, NOAA
Honolulu, Hawaii

The Central North Pacific was the scene of two hurricanes, one tropical storm and four tropical depressions in 1986. Only a tropical depression (One-C) formed in the region. The two hurricanes are described below and the tracks can be found in the previous article.

Hurricane Estelle

July 21-25

Hurricane Estelle developed on July 18 in the eastern Pacific near 10°N, 115°W. Estelle crossed 140°W and into the Central Pacific

Hurricane Center's (CPHC) area of responsibility at about 0600 on the 21st. ESTELLE was a well developed and quite powerful hurricane during the previous 24 hours, when her maximum sustained winds were estimated at 115 knots. While in the area between 130°W and 140°W, ESTELLE was moving toward the west northwest at 20 knots and maintained this forward motion after she crossed 140°W.

The synoptic pattern over the North Pacific during Estelle's early days had been rather unique for mid summer with strong pressure features more reminiscent of winter. A large trough in the upper westerlies was located off the west coast of North America during the formative stages of Estelle. This trough retrograded westward and was in the vicinity of the Hawaiian Islands as Estelle made her approach from the east and for a time it appeared she could recurve to the east of the islands or become sheared as the upper westerlies descended in both altitude and latitude near the cyclone. In any event, Estelle started to weaken gradually on July 21st and continued this slow decline over the next few days as she moved rapidly westward and approached the Hawaiian Islands.

The combination of the rapid forward motion speed of about 20 knots on a course aiming directly at the Hawaiian Islands during this intense stage of Estelle's life resulted in some very large swell moving toward the Big Island of Hawaii. With the wave energy and the cyclone moving at approximately the same

RICHARD ABRAM

Calm before the storm.

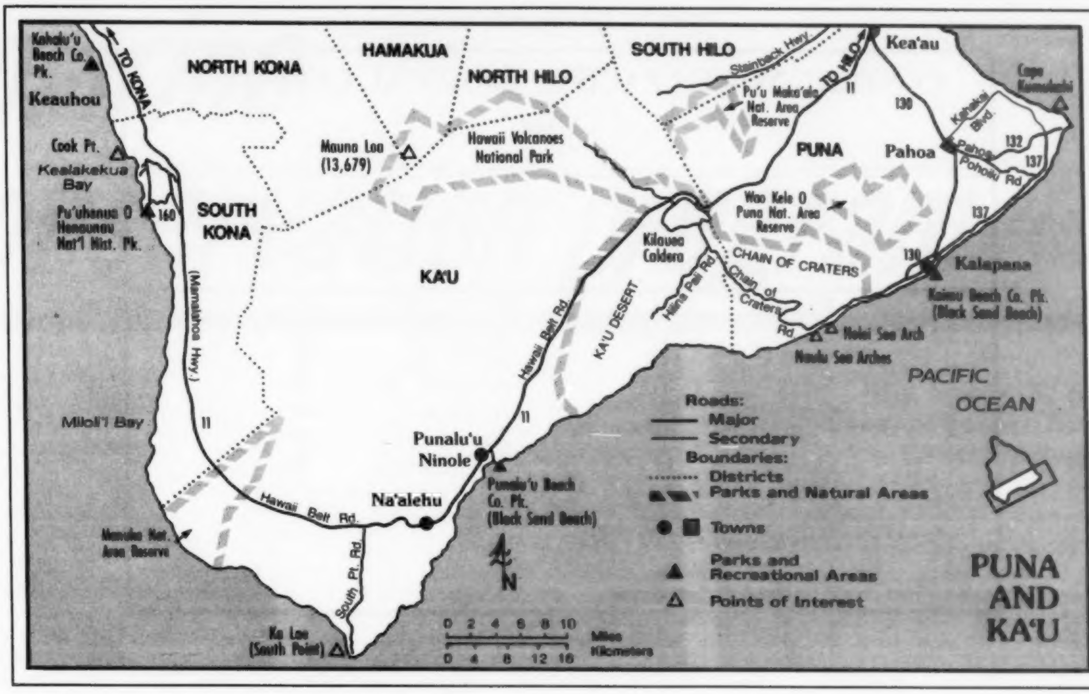
speed, the swell bunched up and hit the east facing shores of the Big Island with high intensity during the afternoon hours of July 22d. All beaches along the southeast coast of the Big Island were evacuated before 10-to 20-foot surf began to pound the shoreline. The waves from

"All the beaches along the southeast coast of the Big Island were evacuated ..."

Estelle came at a time of spring tides, near full moon, and during a period of high water induced by the cyclone itself as strong northeast winds gusting to near 50 miles per hour blew parallel to the Puna and Kau Coast and piled water to the right of it toward the shore. This caused the waves to break higher up on the beach and in the process demolished five beach front homes and caused heavy damage to several others in the Vacationland Estates subdivision. Total dollar damage on the Big Island was estimated at $2 million.

On the island of Maui, the wave action on the eastern coast caused a stretch of dirt roads between Kipahulu and Kaupo to be washed away. On the island of Oahu, two drownings occurred on July 23d and may have been caused by the rough waters associated with Estelle. NOAA buoy 51004 proved to be a valuable observing platform. Forecasters at the CPHC were able to obtain vital wind, pressure, and wave data as the Estelle approached the Big Island. The lowest pressure, peak wind, and largest sea height was reported on the 22d at 2300, with Estelle about 30 miles south of 51004. The lowest hourly pressure reported was 1000.6 millibars, the maximum winds 080° at 52 knots gusting to 66 knots and the largest waves were 34.4 feet.

Estelle's closest point of approach to the southern most tip of the Big Island of the Hawaii occurred on the 23d about 1000 when her center passed about 120 miles to the south with maximum sustained winds estimated near 75 knots. Winds on the Big Island were not unusually strong with speeds estimated at 40 to 50 miles per hour over locally exposed areas. Rainfall was also light during the passage of the tropical cyclone. However, heavy showers did occur when Estelle



These beaches were closed in anticipation of Estelle.

was southwest of the Big Island and some 48-hour rainfall amounts in the 5-to 10-inch range were reported over the Kau and Puna districts. There were no reports of serious damage or casualties to ships attributed to Estelle.

RICHARD ABRAM

Hawaii is usually a hurricane-free paradise.

Hurricane Orlene

September 21-24

Hurricane Orlene formed out of tropical depression 22-E which developed within an active trough to the southwest of tropical storm Madeline in the vicinity of 10°N, 14°W on the 21st. The Eastern Pacific Hurricane Center (EPHC) issued the first few advisories as the poorly defined center was located just east of 140°W and there was a good chance that 22-E would recurve and follow Madeline north northeastward. Twenty Two-E was classified as a tropical storm on the 21st at 1200. A few hours later, a distinct eye could be seen devloping in satellite imagery and the EPHC upgraded the tropical storm to a hurricane, at 2300, and passed the responsibility for the issuance of advisories to the Central Pacific Hurricane Center (CPHC).

GEORGETTE

While Georgette did not reach hurricane intensity, east of the Dateline, it nonetheless was an interesting storm. It became the first tropical cyclone since before 1966 to begin in the eastern Pacific continue across the central waters and finally dissipate in the far western Pacific. The cyclone began on the 2d of August near 9° N, 133°W. It was a tropical storm when it crossed the Dateline. Once into western waters it reached typhoon intensity. It then weakened, rotated about and died 250 miles south southwest of typhoon Tip on the 15th.

Table 1. -- Summary of the season

CENTRAL NORTH PACIFIC TROPICAL CYCLONES 1986				
NO.	NAME	CLASS	DATES	MAX. WIND (knots)
1.	Estelle	H	Jul 21-25	115
2.	One - C	Td	Jul 27-28	30
3.	Ten - E	Td	Jul 29-30	30
4.	Frank	Td	Aug 1-2	30
5.	Georgette	T	Aug 3-4	40
6.	Lester	T	Sep 16	30
7.	Orlene	H	Sep 21-24	70

H - Hurricane
T - Tropical Storm
Td - Tropical Depression

Orlene tracked almost due northward just west of 140°W with maximum sustained winds estimated at 65 to 70 knots. Orlene soon started to move into an environment with unfavorably strong southwesterlies aloft and slightly cooler sea surface temperatures, subsequently was downgraded to a tropical storm at 1800 on the 23d. Stripped of its upper level circulation, the low level remains of tropical storm Orlene took on a westerly course at a relatively slow rate of 5 to 10 knots. Late on the 24th Orlene was downgraded to a tropical depression. There were no reports of damage or casualties to ships.

The staff includes Wyman Au, Andrew Chun, Hans Rosendal and Raymond Sewake.

The complete summary of the tropical cyclone season in the Central Pacific is available as NOAA TECHNICAL MEMORANDUM NWSTM PR-32. It is entitled 1986 Tropical Cyclones - Central North Pacific and includes satellite imagery, a full technical discussion of all storms, including the tropical depressions, and stastics on best track versus forecast track.

marine observation program

--by Martin S. Baron
National Weather Service
Silver Spring, Md.

Satellite vs Ship

Ships' officers frequently ask about weather satellites and the impact they should have on shipboard observation programs. Has the need for ships' weather observations been lessened since the onset of the satellite era?

There are now five geostationary weather satellites worldwide. The United States has two (above the equator at 75°W and 135°W), Japan, India, and the European community each have one. The U.S. and U.S.S.R. each have several polar orbiting weather satellites. Satellite cloud photo imagery is very good at identifying both convective and stratiform cloud development and movement and often helps locate smaller scale atmospheric disturbances that can trigger the growth of mid-latitude cyclones. Satellite imagery also helps locate tropical weather systems and assists in determining their strength.

But few of the meteorological elements in the ship synoptic code are available from satellite. Sea level pressure, wind, visibility, temperature and dew point, cloud type, sea and swell -- all vital meteorological parameters -- are not provided by satellite. This information is needed by meteorologists to locate fronts, draw isobars, and identify high and low pressure areas -- all essential for preparing the weather charts from which forecasts are made. Sophisticated numerical weather prediction models also use ship reports as a basic data source.

Through the years ship data has been vital to the experts.

In short, the need for accurate and timely data from ships has in no way been diminished by the presence of weather satellites. To the

" To the marine meteorologist the arrival of a ship's synoptic report is "manna from heaven"....."

marine meteorologist, the arrival of a ship's synoptic report is "manna from heaven," and there is no substitute. We ask all ships' officers to follow the recommended weather reporting schedule as best they can -- 4 times daily at the main synoptic hours of 0000, 0600, 1200, and 1800 ZULU; once every three hours from within 300 miles of named tropical storms or from within 200 miles of the U.S. and Canadian coastlines. Send a special weather report whenever you encounter weather significantly worse than forecast (using the prefix SPREP).

Correct Format for Weather Obs

In order for ships' weather observations to reach the National Meteorological Center (MMC), and National Weather Service (NWS) Forecast Offices, the reports must be formatted in code FM 13-VII, described in NWS Observing Handbook No. 1. The first three groups of the weather message are particularly important -- missing spaces or illegal characters here can prevent the computer from identifying the ship or from using the report. These three groups are:

D...D YYGGi$_w$ 99L$_a$L$_a$L$_a$

D...D is the ship's radio call sign. It is always the first group in the message, and must be separated from the next group with a single space. Prefixes such as STORM and SPREP can precede the call letters as the situation warrants.

YYGGi$_w$ - YY, the day of the month, is reported as 01, 02, etc. GG, the observation time, is rounded to the nearest whole hour. A report taken at 0555 ZULU is reported as 06. i$_w$ is the wind indicator. 3 is used if wind speed is estimated; 4 if measured with an anemomenter.

99L$_a$L$_a$L$_a$ - 99 is the indicator for ship's position groups, and identifies the message as a ship report. Before accepting any ship report, the NMC computer scans the message for the 99. If it is missing, or appears with the wrong group, the report is rejected. L$_a$L$_a$L$_a$ is latitude in whole degrees and tenths of a degree with no decimal point. Tenths of a degree is computed by dividing the minutes by 6 and rounding down (removing the resulting fraction). 46° 43' is reported as 467, etc.

When transmitting the report through a U.S. commercial radio station, the day/time and latitude groups and all following groups should be combined into 10-character groups, to save the NWS money. The call sign is never combined with any other group.

Bathy vs Met Reports

During the past few months, some Bathymetric report have arrived at NMC coded like ships' weather reports with the call letters preceding the message. These reports cannot be used. Bathy messages should begin with the JJXX indicator followed by the standard report, which ends with the ship's call letters. JJXX is immediately followed by the day/month group.

Communication Payments

This letter to Carl Torgerson, REO with American President Lines is printed to help clarify the NWS policy on payment of weather report communications costs.

Dear Mr. Torgerson:

Thank you for your letter regarding communications' costs for transmitting ships' weather observations.

The NWS pays the transmission charges for all observations coming from areas where we prepare weather forecasts and warnings. In the Atlantic Ocean, this covers the area west of 35°W and north of 3°N, including the Gulf of Mexico and Carribean Sea. In the Pacific Ocean, all areas east of 160°E and north of 25°S are covered. We also pay transmission costs for reports coming from all waters south of 60°S and from the Guam area -- between 5°N - 25°N and from 135°E to 160°E.

This payment policy for ships' weather reports is in effect 24 hours a day, and applies to all observations -- at main synoptic times (0000,

0600, 1200, 1800Z) and intermediate standard times (0300, 0900, 1500, 2100Z), and includes storm, SPREP, and 3-hourly reports. You should send the report as close to the reporting time as practicable. If you are going off watch before the regularly scheduled reporting time, it is all right for the mate to hand you the report an hour early for transmission.

The NWS prefers that you send the reports through U.S. Coast Guard stations, in order to save money. However, if INMARSAT is your primary means of communications, we encourage you to transmit via SatCom.

I hope all of your questions in this regard have been answered. If American President lines is billed for weather reports coming from the designated areas, please bring this to my attention. I welcome any other questions you may have on the Voluntary Observing Ship Program.

Hurricane Season Again

June 1 - November 30

The hurricane season is fast approaching. Ships' weather reports from within tropical storms or hurricanes are very useful to the meteorologist. They provide information about storm intensity, growth, and movement. When within 300 miles of a named tropical storm, please transmit observations at least once every 3 hours. If the wind is 48 knots or more, use the prefix STORM before the ship's call letters in the weather message. Following the weather message, you should mention the storm by name and try to provide wind gust data. If air pressure has bottomed out and begins to rise, include the minimum pressure data.

Example:

STORM (Standard Weather Report)
Hurricane Dawn 1640Z
Sust. wind 95 KT Gust to 115 KT min. pressure 950 HPA 1615Z

tips to the radio officer

--by Jullie L. Houston
National Weather Service
Silver Spring, Md.

Important Reminder!!!

Some ships transmitting OBS via USA CES INMARSAT are neglecting to disconnect the transmitter after sending their observations. This is causing a substantial cost to the National Weather Service (NWS). The NWS limit for an observation is not to exceed two minutes. For example, a ship failed to disconnect its sending equipment after completing the message leaving the transmitter open for 89 minutes, costing a total of $404.95.

The NWS also reminds ships to use the correct format for Meteorological Surface OBS and Bathythermal OBS.

For example:

(1) Bathys should start with **JJXX** and end with the **Call Sign**.

(2) Met Surface OBS should begin with the **Ship's Call Sign** and end with **Five Periods**.

Interlacing Bathy and Ship Surface OBS format in one transmission results in loss of data within the system.

National Weather Service - San Francisco, CA
Radiofacsimile Schedule Transmitted by U.S.C.G.
Point Reyes, CA

TIME (GMT)	AREA	CHART	TIME (GMT)	AREA	CHART
0120	5	Surface Forecast Valid 00Z	1720	6	12Z Tropical Analysis
0130	5	Sea Forecast Valid 00Z	1730	5	12Z Surface Analysis
0305	3	Sea Surface Temp Anal.	1740	6	Satellite Imagery
0315	4	Sea Surface Temp Anal.	**2005**		**Radiofax Trans Sched**
0325	3	Sea and Wx Fcst Valid 12Z	2015	5	500MB Strmln-Max Wind
0335	4	Sea and Wx Fcst Valid 12Z	2025	5	Satellite Imagery
0505	5	00Z Surface Analysis	2335	6	18Z Tropical Analysis
0515	5	Extended Surface Fcst	2345	5	18Z Surface Analysis
1515	7	Sea Surface Temp Anal			

Area: 3 40N - 52N, East of 135W
4 28N - 40N, East of 136W
5 30N - 60N, East of 160E
6 20S - 30N, East of 160W
7 Equator - 50N, East of 180

Frequencies (KHz): Assigned 4346.0, 8682.0, 12730.0, 17151.2
Carrier 4344.1, 8680.2, 12728.1, 17149.3

Comments are invited. Please write: National Weather Service, 600 Price Av., Redwood City, CA 94063. Visit us when in port.

the mail bag

Northwest Passage Update

A nice letter was received from Ian W. Ray of Halifax, Nova Scotia concerning the history of the Northwest Passage:

Although it is recognized that the 1985 voyage of the USCGC Polar Sea may be considered an historic event in the annals of American Coast Guard history in the broader sense of the word it must stand in line behind vessels, which in the past have circumnavigated the North American continent. The Canadian Coast Guard in particular have had a long and distinguished record of service in the Canadian high arctic. I do not wish to diminish any other country's endeavours in this field, however, you must

understand that since 1954 we have had various ships that have circumnavigated the North American continent. Since this date seven Canadian Coast Guard icebreakers have accomplished this task, the first of which was the C.C.G.S. LABRADOR in 1954 (then under control of the Royal Canadian Navy) followed by numerous vessels of different countries.

We thank Mr. Ray for this information, which we were unaware of. There was no intent on our part to diminish these important voyages. Mr. Ray mentions that this list may only be partial, but it does add to the history for which we are appreciative.

In addition Gordon Hall, Vice President/Tresurer of the Lake Carriers' Association reminded us of the two previous U.S. circumnavigations, which although were not solo were certainly significant.

HISTORY OF NORTH AMERICAN CONTINENT CIRCUMNAVIGATION

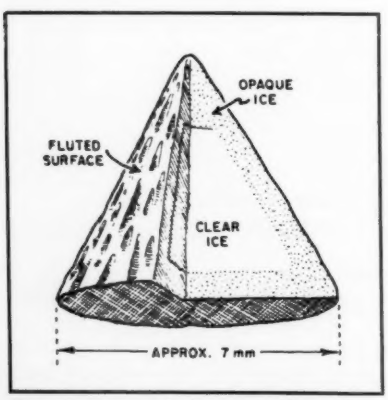
YEAR	NAME	FLAG	REMARKS
1954	LABRADOR	Canada	First continuous circumnavigation of N. Amer.
1957	USCG STORIS USCG SPAR USCG BRAMBLE	USA	First U.S. circumnavigation.
1970	CSS HUDSON	Canada	First circumnavigation of the Americas.
1970	CSS BAFFIN	Canada	
1975	PANDORA II	Canada	
1976	CCGS J.E. BERNIER	Canada	
1979	CCGS LOUIS S. ST. LAURENT	Canada	To assist SIR JOHN FRANKLIN. Both returned via Panama Canal.
1979	CANMAR KIGORIAK	Canada	
1980	CCGS J.E. BERNIER	Canada	Icebreaker/buoy tender.
1980	PANDORA II	Canada	
1981	CSS HUDSON	Canada	
1979-1982	MERMAID (yacht)	Japan	Broken voyage but circumnavigated the Americas.
1985	POLAR SEA	USA	First American solo success.

the editor's desk

EDITOR NOTE

This month we are pleased to introduce a new column entitled "Beyond the Rainbow".

This is a compilation of unusual natural phenomena at sea. The material is being provided by William R. Corliss of the Sourcebook Project. It has been excerpted from a few of his many interesting catalogs



Example of unusual phenomena (featured in future column) -- conical hailstone.

dealing with anomalies in a variety of fields. They have published a number of catalogs and handbooks in Astronomy, Biology, Geophysics, Archeology, Geology and Psychology.

In the field of Natural Phenomena many of the records and accounts come from ships at sea. For years these have been documented in our sister publication The Marine Observer -- published by the British Marine Meteorological Office. It is hoped that the accounts provided by William Corliss will be useful in explaining some of these unusual occurrences and will also encourage the reporting of others.

Information on the publications available from the Sourcebook Project can be had by writing to:

The Sourcebook Project
P O Box 107
Glen Arm , MD 21057

A bimonthly newsletter, Science Frontiers is also available. This is a collection of scientific anomalies found in current literature.

Willie Muldoon

William E. (Willie) Muldoon, Weather Observation Specialist at WSMO Portland Maine died Sunday, February 15, 1987 after a brief illness.

Willie served the National Weather Service long and faithfully, beginning back in 1948. After a short tour at Canton Island in the Pacific, he joined the old Atlantic Weather Patrol, (AWP) based in Boston, his city of birth. Concurrent with that assignment he completed his Bachelors Degree and graduated from Boston College in 1950. He served over 20 years with the AWP, completing over 200 patrols. Among his many accomplishments was the fact that Willie was fluent in Spanish. Therefore, he was selected for a special assignment to the Argentinian ship ELTANIN for special weather patrols from Chile to the Antarctic. Finally, he moved to the WSMO in Portland where he has worked for the past 14 years.

Willie was an Army veteran of World War II and a member of the American Legion and Knights of Columbus. Willie was active in his life, being an amateur radio operator and working as a volunteer interpreter for the Portland Refugee Resettlement program.

Surviving are three sons, Robert E., David A. and Charles E. all of Portland, and a brother, Charles J. Muldoon of Medford, Massachusetts.

NTSB PRIDE Report

The lack of watertight bulkheads within the PRIDE OF BALTIMORE contributed to the rapid flooding of the ship in a severe storm, resulting in its sinking within five minutes, the National Transportation Safety Board has found.

The tall ship sank on May 14, 1986, in the Atlantic Ocean about 250 miles north of Puerto Rico after encountering a sudden, high velocity wind that exceeded the ship's stability, the Board said, causing the ship to heel over. Water poured through an open hatch on deck, preventing the vessel from recovering from the knockdown. Four of the 12 crew were lost.

Contributing to the loss of life, the Safety Board said, was the inability of the crew to retrieve life preservers from their stowage below deck and the subsequent malfunction of vessel's two inflatable liferafts.

The Board recommended to the Pride of Baltimore, Inc. that in any future design, construction and operation of sailing vessels it comply with U. S. Coast Guard regulations for passenger sailing vessels in ocean service. The PRIDE was an uninspected vessel. It was not certified nor required to be certified by the Coast Guard for ocean voyages.

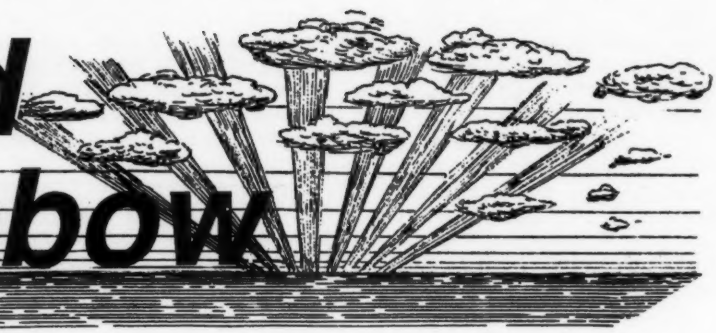
The board also recommended to the company that in future operations, it develop and adhere to a routine communications schedule so that any failure to meet the schedule would be immediately apparent. In the PRIDE sinking, there was in indication on land that something had gone wrong until the survivors were picked up four days after the sinking.

The NTSB recommended that the Coast Guard seek authority to require uninspected vessels on offshore voyages to carry Class A Emergency Position Indicating Radio Beacons (EPIRB), which are valuable in search and rescue operations. The Board also recommended that the Coast Guard require the stowage of life preservers on uninspected vessels close to or at emergency stations to facilitate immediate access in the event of a sudden, catastrophic event.

Recommendations were also issued to the Society of Professional Sailing Ship Masters, Zodiac of North America (manufacturers of the liferafts on the Pride) and the National Weather Service.

The Safety Board's complete printed report, which should be identified as PB-87-916401, may be purchased by mail from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

beyond the rainbow



--by William R. Corliss
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" Unusual natural phenomena at sea "

The atmosphere plays many curious optical tricks, from sideways mirages to all-red rainbows to radar "angels". The venerable laws of optical reflection, refraction and color dispersion are adequate to explain the great majority of these frequently breathtaking displays of colors, shadows, halos, and distorted images. Undoubtedly, the same laws will ultimately explain most of the rarer phenomena, but the theoretical attempts made so far have not been completely satisfactory. How does one account for elliptcal halos, kaleisdoscopic suns, long-delayed radio echos, and all the trickery of mirages?

Actually, only a few scientists take much interest in atmospheric optical phenomena nowadays. They are for the most part content that these "minor" esoterica can be brought into the fold of the scientifically explained with little effort, that we already know all that is really important about light, color, and the progagation of radio waves in the atmosphere. This attitude is, of course, smug and dangerous. It is regrettable that so many of the irregular atmospheric phenomena transpire at sea, on mountaintops, in the polar reaches, and in other remote places. Only a favored few witnesses can marvel at these natural nuances of sunlight and moonlight. By necessity, these columns will be mainly the testimony of mariners, explorers, and those who frequent the remote, open places of the world.

Everyone knows the rainbow and just about everyone also knows that it is produced by sunlight falling on a veil of raindrops. In more scientific terms, the sunlight (or moonlight) is dispersed into the spectral colors by refractions and reflections inside the transparent raindrops. Two internal reflections create the primary bow; three reflections produce the larger, rarer secondary bow with a reverse color sequence. Such commonplace rainbows are excluded here as unmysterious, but this still leaves offset rainbows, distorted rainbows, sandbows, moving rainbows, and many other intriguing color phenomena associated with naturally dispersed water droplets.

How do all these variations of the basic rainbow phenomenon arise? The classical rainbow situation may be complicated by several factors. Most important is the presence of an additional source of light, which usually is due to the reflection of sunlight from an unruffled body of water. Vertically displaced rainbows are just one result of reflected sunlight; one can imagine ripples and swell introducing addi-

tional distortion effects. A low sun is a second source of distortion, because its light has lost some of the normally present violets and blues due to scattering through the longer atmospheric path. The presence of thin, intervening sheets of rain also superimpose new colors and bows on the basic rainbow. Even with these known perturbations, many rainbow phenomena cannot be explained using conventional rainbow theory.

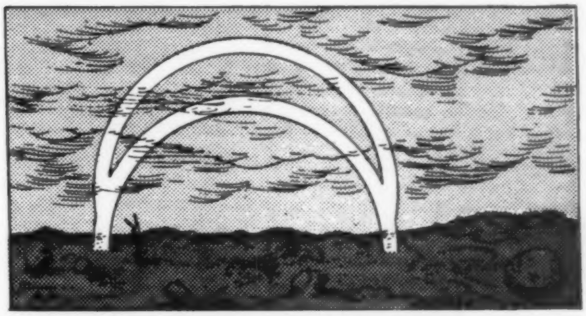
Unusual Multiple Rainbows

Description. Rainbows or rainbow segments appearing in additon to the ordinary primary and secondary bows. These extra rainbows are displaced vertically upwards or downwards; their colors maybe in the same order as those of the primary or reversed. Such additional bows should not be confused with supernumerary bows, which are much narrower than the primary, show only a few colors, and appear just inside the primary. Extra bows that can be explained in terms of a second source of illumination---usuallly the sun reflected from a placid water surface---are eliminated in most instances as rare but explicable.

Data Evaluation. A handful of good observations with careful descriptions of color order, bow position, and optical environment.

Anomaly Evaluation. If it is assumed that "reflection bows" have been eliminated, we have rainbows that do not yield to standard rainbow theory. The phenomena portrayed below, in fact, may encompass several different effects. It is impossible to say at this time whether they are the results of unrecognized optical phenomena and thus important anomalies or whether some second source of illumination has been overlooked.

Possible Explanations. Extra bows may be created when the sun is reflected from water, ice, and even glass in manmade structures. The possibility also exists that two or more curtains of raindrops at different distances from the observer may create more than one bow along the same axis.



Multiple rainbows apparently created by two showers.

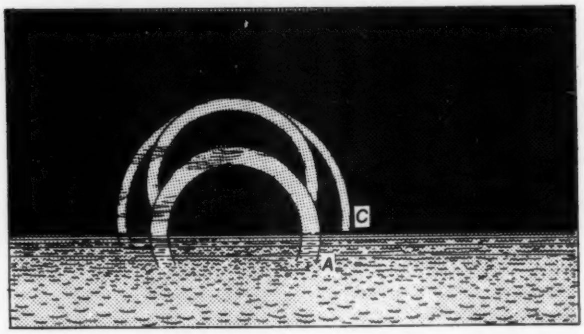
Example of Unusual Multiple Rainbows.

1. 1873, England, "I send a sketch of two rainbow eccentric to each other, even at the same time, a few evenings since, just before sunset. An explanation of the phenomenon is simple. A magnificent rainbow was being refracted from a dense shower, when a narrow (if I may use the term) shower came in front of the denser, showing a rainbow on itself, but not intercepting, only refracting, the sun's rays on and from the further shower." Most multiple rainbows are explained in terms of sunlight reflected from a nearby water surface; but here we have a new twist.

2. March 25, 1955, North Atlantic Ocean. "Observed part of a rainbow, bearing between 078° and 110° (the sun bearing 255°), against a background of dark Cb cloud without anvil. The colours were very pronounced and were repeated in an inverted form. Altitude of sun 22½° .....Note. This interesting observation is of an abnormal rainbow. The colour sequence of the upper half of the combined bow corresponds in colour sequence to that of a primary bow. The lower half could not be a supplementary rainbow since the colour of this would be in the same order as in the primary bow, viz, red on top. Furthermore, a supplementary bow

is much narrower than the primary bow and seldom shows more than two colours, green and red. The note was added by the Marine Observer editor.

3. November 26, 1961 Indian Ocean. "At 0030 GMT a line squall was observed ahead of the vessel, moving approx. SE'S; a single rainbow was seen to form which very clearly showed the colours of the spectrum. Ten min, later as the vessel was passing through the line squall, then lying NE'N-SW'W, a triple rainbow was seen directly ahead. All three bows had the same order of colours -- red on the outside and violet inside. The colours of the primary (A) were very clear, almost vivid; this was the broadest of the three bows and it curved down almost to the sea surface, on each side of the forward part of the vessel. This bow was reflected on the sea surface, but the other two were not. At 0045 there was a moderate shower which lasted for 3 min, after which the bows disappeared. There was no wind and the sea was like a mirror, but with a moderate swell from 150°.....Note. m.v. CITY OF KHARTOUM observed a most unusual rainbow phenomenon. Bow A in the diagram appears to be the primary bow. Bow B, covering more than a semicircle, appears to have been caused by the reflection of the sun's light at the smooth sea surface before its being refracted by the raindrops. Bow C is similar to a secondary bow but with a reversed order of colours. We cannot explain this.



Triple rainbow in Indian Ocean.

4. June 6, 1979, Reading, England. "On 6 June 1979 at about 6:45 pm, I observed an unusual rainbow from the University athletic pavilion at Whiteknights, Reading. A heavy shower had just passed towards the southeast and rainbow with primary and secondary bows was visible. The primary bow appeared to be double, being formed of two bows--one being displaced upwards by the width of a single bow from the other. Both bows had the same radius, this being shown by the two bows merging near the horizon. After a minute or two the upper-most bow faded leaving the ordinary single primary bow. Both bows were complete, with bright colours, and this event was not to be confused with a distinct supernumary bow."

References

1. Mackaeg; "Rainbow," English Mechanic, 16:410, 1873.

2. Harrison, P.P.O. "Rainbow," Marine Observer, 26:15, 1956.

3. O'Neill, F.C.; Triple Rainbow," Marine Observer, 32:185, 1962.

4. Judd, S.; "Double Primary Rainbow,", Weather, 34:445, 1979

hurricane alley

hurricane alley

Ram Krishna
Fiji Meteorological Service

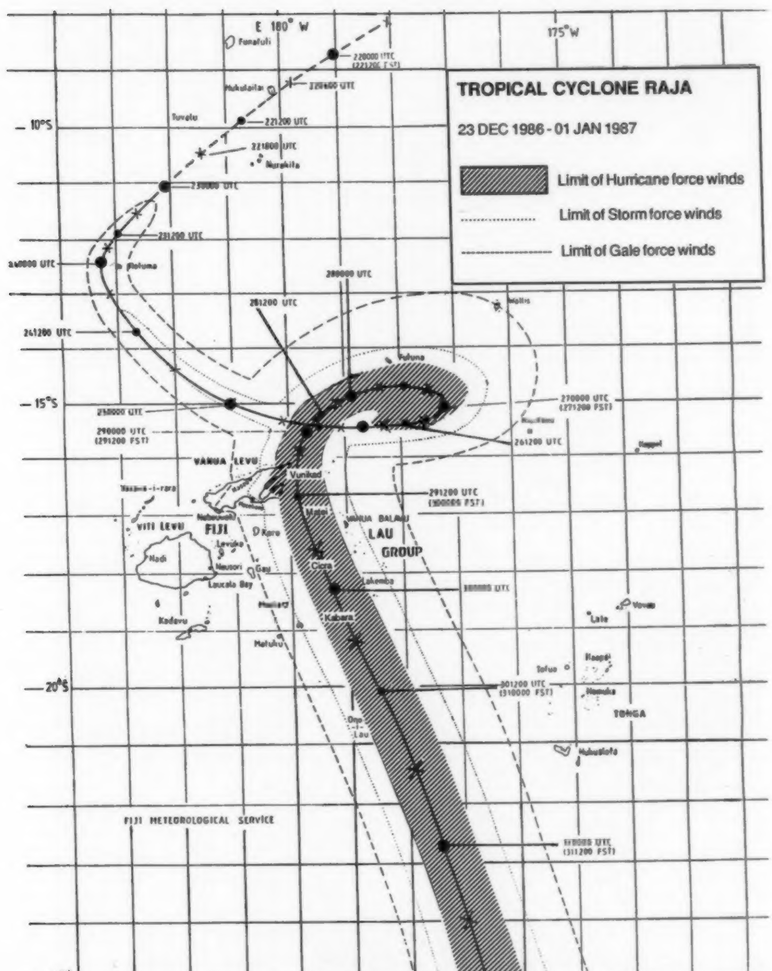


Figure 1. -- Track of Raja.

Tropical Cyclone Raja

Dec 22 1986 - Jan 1, 1987

Tropical cyclone Raja had a relatively long history and a complicated track. It passed close to the west of Rotuma in the early stages of its development. Subsequently it made a counterclockwise loop in the area south of the Futuna Group, bringing near hurricane force winds to Futuna and gales to Wallis. It passed close to the east of Udu Point on the evening of December 29th and across the Lau Group on the 30th (figure 1).

Raja is estimated to have reached hurricane intensity with maximum sustained winds of 70-75 knots (with gusts up to 100 knots) early on the 27th of December, and it maintained this intensity for most of its life through Fiji.

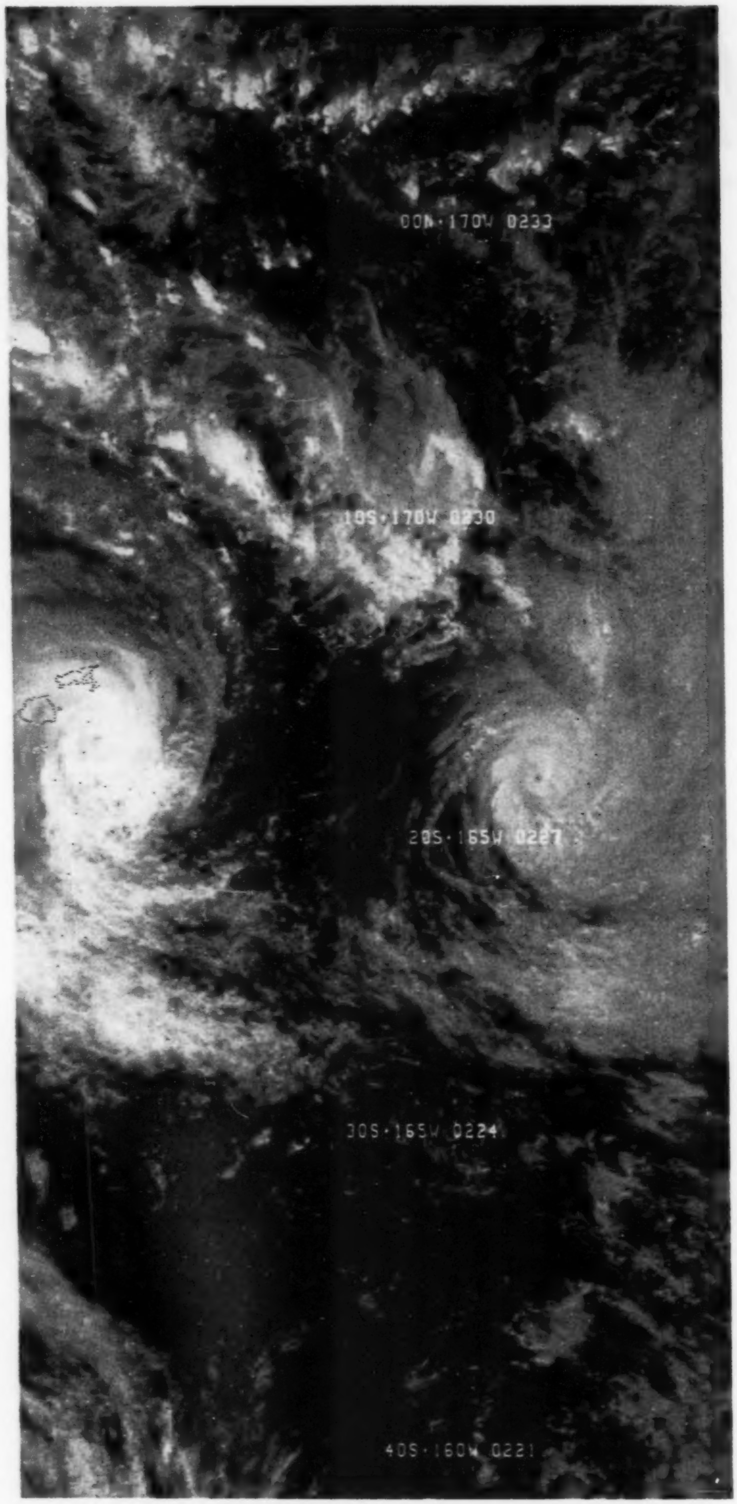
Raja caused extensive damage to crops, coastal installtions and buildings through high winds, flooding, landslides, storm surge and wave action especially in Fiji and the Futuna Group. It caused the loss of two lives, one in Futuna and the other in Fiji. The

total provisional estimated damage in Fiji was $20 million.

Raja was classified as a tropical cyclone at about 0600 on the 23d, when it is estimated to have attained maximum sustained winds of 35 knots. As it approached Rotuma on the afternoon of the 24th winds at Rotuma turned from easterly to northwesterly and eventually southwesterly on the morning of the 25th, as the cyclone began to turn southeast. Satellite pictures suggested that sustaned winds in Raja had reached about 45-50 knots by 0900 on the 24th. As the cyclone passed to the north of Udu Point on the evening and night of the 25/26th, the cyclone gave sustained easterly winds of about 25 to 30 knots at the station. Close to the centre itself, some 50 to 60 miles to the northwest of the station, maximum sustained winds were estimated at around 60 knots. By 0600 on the 26th cyclone Raja was estimated to have reached hurricane intensity with maximum sustained winds of around 65 knots.

On its westward track, south of Futuna, the maximum measured winds were not available since the station was blown down by the cyclone. However, from damage reports it is likely that sustained winds of 60-65 knots would have been experienced at the island. Maximum sustained winds at this stage were estimated at around 70-75 knots.

At Udu Point the anemometer mast at the weather station came down at measured windspeeds of around 70 knots with gusts to 90 knots. The estimated maximum



Raja (left) and Sally look like twins posing for a portrait on the 30th at 0200. Both are featured in this column.

sustained wind experienced at Udu Point is around 70 knots. Subsequently the cyclone maintained its intensity throughout its passage across the Fiji Group. The maximum sustained winds reached in Raja are estimated at 70-75 knots.

Although winds reported from Rotuma were no more than gales, damage to crops and coastal roads was quite extensive. About northeastern Vanua Levu, the Lau Group and the Koro Group severe damage was reported in areas affected by hurricane force winds, and somewhat less damage was reported in areas with storm force winds. Crops, communication facilities and buildings suffered severe damage. A combination of storm surge, wave action and heavy rain caused considerable damage to roads, seawalls, wharves, jetties and other coastal installations in low-lying areas and islands. One person was killed in Lakeba while trying to move a boat to safer anchorage.

In Labasa, torrential rain, prolonged due to the slow movement of the cyclone, combined with storm surge to give the worst floods in the living memory of most people. Newspapers reported water up to a meter deep in places on the main street in Nasea town. An eye witness stated that it was the "worst flood in Labasa since December 1929".

Storm surge compounded with the abnormally high astronomical tides and wave action caused considerable damage mostly on the left side of the track to roads, seawalls, wharfs, jetties and other coastal installations on the northern, northeastern or northwestern side of low-lying coastal areas of islands. Accounts of storm surge are often confused with wave swash, and therefore difficult to estimate. However, surges of the order of 2 to 3 meters appear to have occurred. Reports have been received of wave heights of 30 to 40 feet. Large deposits of sand brought in by waves into Fijian village grounds and building were reported in some cases. The inter-island ferry Romanda was wrecked on a reef near Nairai island. At Futuna the cyclone caused the death of one person and extensive damage to food crops (80% of food crops destroyed). Houses of light construction were totally destroyed and many buildings of more modern construction sustaned severe damage.

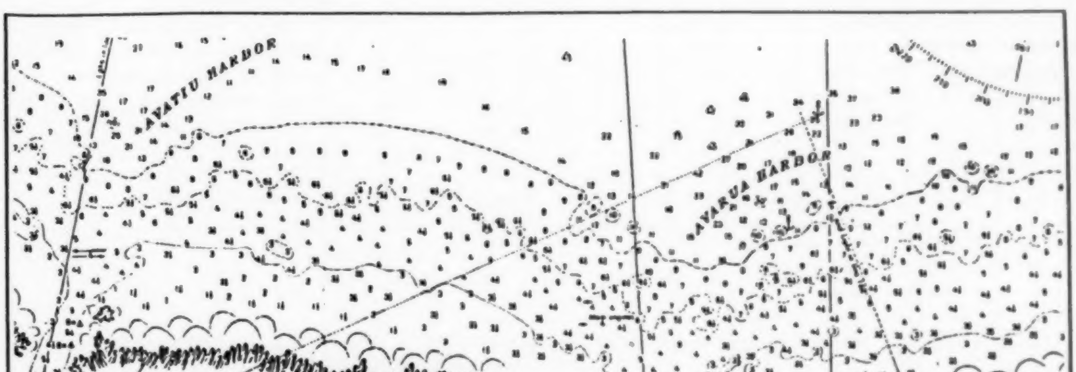


Figure 2. -- The northern coast of Rarotonga

Hurricane Sally

The following report was sent by Saul Price staff Meteorologist, Pacific Region, NWS. Over the years Saul has kept us well informed as to the trouble caused by South Pacific hurricanes. The report was written by Gordon Burton, Director, Pacific Tsunami Warning Center and describes the impact of Sally on Rarotonga, Cook Is, and specifically on the tide house containing a Handar Data Collection Platform (DCP) used to transmit sea level data for both tsunami detection and mean sea level studies.

SALLY first appeared as a tropical depression east of American Samoa on about December 24, 1986 and moved slowly south-eastward through the Cook Islands, passing just to the north of Rarotonga on January 1-2 as a fully developed hurricane described by the Meteorological Service of French Polynesia as "exceptionally intense for the season".

Other than the usual effects of hurricane, the event had two noteworthy features; first, the survival and continued operation of the Handar, despite the loss of all its external instrumentation and the destruction of the tide house; and second, the 16-foot rise in sea level -- an unexpectedly large storm surge for a small oceanic island, with its steep offshore drop.

However, as the enclosed map of Rarotonga's northern coast shows (figure 2), the location of the tide house at the inland end of one of the two prominent breaks in the fringing reef would suggest that the storm surge in that area may have been augmented by a local bore and that destructive waves reported to have been as much as 35 feet high could have penetrated much farther inland than where the reef was intact.

Because of the destruction of the tide house and external sensors, the Rarotonga tide gage was unable to record the peak of the surge. A replotting of the tide record was made by Bernie Kilonsky of the University of Hawaii (figure 3).

The uppermost curve represents the predicted tide cycle. The middle curve, on a vertical scale of 150mm/division, shows the actual tide, as recorded from a floatwell by a Leupold Stevens Automatic Digital Recorder (ADR), at a rate of one value every 15 minutes.

The lowest curve represents the residual tide obtained by subtracting the predicted tide cycle from the ADR, and was derived from a digital encoder interfaced with a separate float well. The plot is on a vertical scale of 50mm/division.

The increasing "noisiness" of the tide record reflects increasing wave action as the slow-moving storm approached.

Data gaps earlier in the record were probably due to incomplete transmissions via GOES, and those on January 2 to the loss of instrumentation when the tide house flooded.

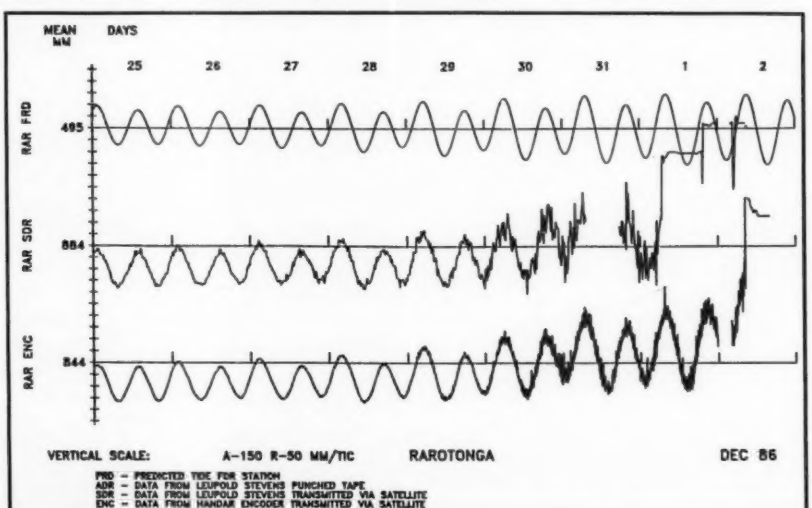


Figure 3. -- The tide record.

Selected Gale and Wave Observations

October, November and December 1986

Vessel	Nationality	Date	Position of Ship: Lat. deg.	Position of Ship: Long. deg.	Time GMT	Wind: Dir. 10°	Wind: Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C. Air	Temperature °C. Sea	Sea Waves† Period sec.	Sea Waves† Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.*	Swell Waves Height ft.
	ATLANTIC	NOV.															
RAINBOW HOPE	KNDB	8	56.5 N	36.7 W	18	29	48	5 NM	85	0991.5	0.6	5.6	5	11.5	26	6	36
RAINBOW HOPE	KNDB	15	58.8 N	35.9 W	18	32	50	.25 NM	74	0953.5	1.1	4.4	3	19.5	31	10	31
SEALAND ADVENTURER	KSLJ	19	39.6 N	67.6 W	18	32	M 52			1002.2	8.0	17.2	8	16.5	32	14	32.5
SEALAND ADVENTURER	KSLJ	19	39.4 N	67.7 W	21	33	M 45	5 NM	02	1010.0	7.0	17.3	8	16.5	34	12	29.5
RAINBOW HOPE	KNDB	21	55.6 N	38.1 W	18	29	50	.5 NM	74	1006.6	3.3		5	14.5	30	10	32.5
TRAVE ORE	ELBZ4	22	40.0 N	49.6 W	15	18	58	1 NM	62	1005.5	22.0	18.0	11	13	20	24	29.5
	ATLANTIC	DEC.															
HANJIN CHEJU	3EVP4	10	44.9 N	31.2 W	12	28	M 50	10 NM		1019.6	7.2	15.0	7	16.5	28	11	29.5
HANJIN CHEJU	3EVP4	10	45.0 N	31.8 W	18	28	M 50	5 NM		1002.2	9.0	14.0	7	16.5	28	11	29.5
HANJIN CHEJU	3EVP4	12	44.9 N	36.3 W	00	28	M 49			1005.0	9.0	14.0	6	16.5	28	9	31
HANJIN CHEJU	3EVP4	12	44.9 N	36.7 W	06	29	M 52	2 NM	07	1012.0	10.0	15.0	6	16.5	28	9	31
RAINBOW HOPE	KNDB	15	62.7 N	31.4 W	06	04	50	1 NM	23	0992.1	3.3		7	16.5	14	14	44
RAINBOW HOPE	KNDB	16	60.0 N	33.9 W	00	27	66	1 NM	73	0968.8	2.8				27	10	39
RAINBOW HOPE	KNDB	16	59.8 N	34.0 W	06	25	45	5 NM	07	0974.5	2.8		6	10	26	12	32.5
RAINBOW HOPE	KNDB	16	59.4 N	34.2 W	12	23	54	5 NM	22	0979.5	1.7	6.7	8	16.5	25	10	29.5
RAINBOW HOPE	KNDB	16	59.0 N	34.5 W	18	25	50	10 NM	26	0984.3	0.8		8	19.5	25	12	32.5
	PACIFIC	OCT.															
MOBIL ARCTIC	KSPY	1	19.3 N	155.9 W	06	13	M 55	2 NM	64	1008.9	26.1	26.1	4	10	13	10	29.5
PACMERCHANT	5MCB	1	40.2 N	170.7 E	18	27	M 76	1 NM	63	0985.0	14.0		7	32.5			
BAY BRIDGE	ELES7	2	37.9 N	178.0 E	06	27	M 59	1 NM	25	0990.0	18.0	20.0	12	32.5	26	13	36
SEALAND PATRIOT	KHRF	2	37.8 N	176.8 E	06	29	M 60	1 NM	18	0992.5	17.0	11.1	5	16.5	27	8	32.5
BAY BRIDGE	ELES7	2	37.8 N	177.5 E	12	27	M 60	1 NM	25	0993.0	16.0	22.0	12	32.5	27	13	36
PRESIDENT LINCOLN	KDBG	3	36.4 N	175.7 W	06	27	55	2 NM	61	0993.5	16.9	21.6	XX	19.5	27	13	44
PRESIDENT JEFFERSON	WPSE	3	37.9 N	171.9 W	00	24	45	2 NM	64	0983.5	18.9	18.3	21	39			
PRESIDENT JEFFERSON	WPSE	3	37.8 N	172.3 W	06	29	48	5 NM	25	0987.0	18.3	18.3	16	29.5			
SEALAND DEFENDER	KGJB	8	36.8 N	176.6 W	12	26	M 45	.5 NM		0998.0	17.5	18.0	3	10	25	6	31
SEALAND DEFENDER	KGJB	8	38.7 N	177.9 W	18	33	M 45		01	1006.3	17.5	18.0	4	10	33	8	29.5
CORNUCOPIA	KPJC	9	44.4 N	150.2 E	12	02	45	5 NM	01	1006.0	5.0	9.3	12	24.5	06	12	32.5
TONSONIA	KJDG	20	17.6 N	111.0 W	15	13	M 75	1 NM	81		25.0	27.8	4	16.5	13	9	31
TONSONIA	KJDG	20	17.5 N	110.9 W	18	13	M 75	1 NM	81		25.0	27.7	6	21	12	12	32.5
TONSONIA	KJDG	20	17.7 N	110.7 W	21	20	M 70	1 NM			25.0	27.7	6	18	20	10	39
AMERICAN PIONEER	WSRL	26	34.9 N	162.2 E	21	02	60	2 NM	80	0999.6	16.9	22.8	6	26	02	10	29.5
	PACIFIC	NOV.															
HYUNDAI PIONEER	3EYZ4	10	49.9 N	164.3 E	00	28	M 46			1000.0	7.0	7.0	13	29.5	28	12	26
MOBIL MERIDIAN	KESM	18	49.1 N	127.9 W	23	26	48	5 NM	07	0984.6	10.5	11.6	3	6.5	28	6	32.5
EXXON NORTH SLOPE	KHLG	19	49.8 N	131.2 W	00	29	M 64	1 NM	60	0987.2	6.5	12.2	14	31	30	16	36
ADMIRALTY BAY	KACK	23	44.3 N	152.3 W	00	26	50	10 NM		1003.0	10.7	11.1	9	32.5			
CHEVRON LOUISIANA	WHNG	24	49.5 N	135.3 W	00	28	M 50	2 NM	88	1010.0	6.9		3	5	27	13	32.5
SOARER DIANA	DZGY	24	46.6 N	146.8 W	18	25	M 48	2 NM		1003.0	11.5	11.0	11	31			
GLACIER BAY	KACF	24	54.5 N	135.8 W	23	18	60	.5 NM	63	0986.0	7.5	6.7	8	29.5	18	12	23
MOBIL ARCTIC	KSPY	27	45.6 N	130.1 W	06	27	M 50	5 NM	25	1001.5	11.1	11.7	8	29.5			
CHASTINE MAERSK	OWCY	27	46.3 N	166.5 W	06	18	46	2 NM	51	1012.0	6.8	6.0	6	16.5	18	10	29.5
CHASTINE MAERSK	OWCY	27	48.9 N	163.8 W	12	18	45	2 NM	53	1003.1	7.0		6	19.5	19	10	29.5
CHASTINE MAERSK	OWCY	27	49.3 N	161.0 W	18	18	48	2 NM	63	0996.0	8.4		6	19.5	18	10	32.5
CHASTINE MAERSK	OWCY	28	49.6 N	156.3 W	00	22	48	.5 NM		0991.0	9.2		8	29.5	20	11	36
CHASTINE MAERSK	OWCY	28	49.6 N	155.3 W	06	22	47	1 NM	50	0992.0	9.0		8	29.5	20	11	34.5
	PACIFIC	DEC.															
	WTST	1	54.5 N	175.1 W	06	26	M 48	2 NM	29	0981.3	3.3	5.0	8	10	27	22	32.5
PRESIDENT GRANT	WEZD	6	40.1 N	153.0 E	00	29	M 51	10 NM	01	1009.8	5.6	10.0	15	23	30	13	29.5
ALLIGATOR HOPE	ELFN8	6	34.2 N	169.1 E	18	29	M 50	1 NM		1010.5	15.0	20.0	16	29.5	29	20	32.5
REGINA MAERSK	OXGR	6	38.1 N	171.7 E	18	25	48	5 NM	93	0997.8	10.0		9	29.5			
ORIENTAL EXECUTIVE	D5AN	7	38.8 N	173.9 E	00	28	M 69	5 NM	02	0997.0	10.0	13.0	13	36	27	7	19.5
ALLIGATOR HOPE	ELFN8	7	34.1 N	167.7 E	00	31	M 45	5 NM	02	1014.5	14.0	18.0	16	29.5	29	18	29.5
ORIENTAL EXECUTIVE	D5AN	7	38.7 N	175.8 E	06	29	M 55			0998.5	8.5	13.0	9	32.5	29	11	36
ORIENTAL EXECUTIVE	D5AN	8	38.4 N	177.5 W	00	28	M 54	5 NM		0999.0	10.0	13.0	8	29.5	30	9	23
PRESIDENT WASHINGTON	WHRN	16	40.3 N	168.9 E	00	20	M 50	1 NM	63	0977.5	12.8	12.8	11	29.5	25	12	23
SANKO HIBISCUS	3ERK4	21	47.5 N	153.4 E	00	30	M 50			0995.0	- 1.0	2.0	9	29.5	27	11	32.5
PRESIDENT EISENHOWER	KRJG	23	39.1 N	165.7 E	00	29	M 45	5 NM	03	0995.2	2.5	11.9	13	32.5			
PRESIDENT EISENHOWER	KRJG	23	39.1 N	168.3 E	06	27	M 45	2 NM	77	0995.2	3.0	10.3	12	24.5	28	12	32.5
PRESIDENT EISENHOWER	KRJG	23	39.2 N	171.0 E	12	29	M 46	5 NM		0995.5	1.5	9.8	XX	24.5	29	XX	32.5
MING OCEAN	BLHY	29	33.6 N	152.5 W	18	27	M 50	1 NM		1009.5	13.0		10	31			

MARINE WEATHER REVIEW

October, 1986 -- During this transition month the Icelandic Low usually becomes the dominant weather feature over the North Atlantic, while the subtropical high has weakened. This year (fig 1) the stubborn summer high pressure regime hung on west of Spain. This resulted in an abundance of storms in the waters north of 55°N, which is reflected by a stronger than normal (+14mb) Icelandic Low. Pressure was slightly higher than normal off the southeast coast of the U.S. as well as over its mid Atlantic region. The circulation at 700 mb reflected these surface anomalies, resulting in a strong steering current oriented in a west southwest to east northeast direction, which can be verified by the storm tracks for the month.

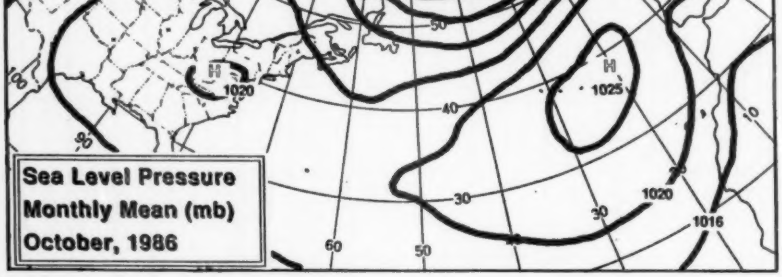


Figure 1. -- This October featured a large 1025-mb High.

On this date -- October 13, 1846 -- The Great Hurricane of 1846 was tracking across Cuba and eventually Florida, Georgia, the Carolinas, Virginia and Pennsylvania. It inflicted major damage along its entire path, which was similar to that of Hurricane Hazel 108 yr later.

Extratropical Cyclones -- The big weather news for the month occurred over Panama. A week of heavy rains caused a large landslide in the Panama Canal, reducing traffic to a single lane. The slide occurred on the 13th in the busy, narrow Gaillard Cut, close to the Pedro Miguel locks, scene of another slide 12 yr ago. Traffic was reduced to one way. The backlog of vessels grew to 81 during the first week of dredging operations. After things started to improve, heavy arrivals and dense fog at the end of the month kept delays at about 2 to 3 days prior to transit.

In the U.S., early in the month, commodity shipping along parts of

The Weather Logs combined with the cyclone tracks, U.S. Ocean Buoy Climatological Data, gale and wave tables and mean pressure patterns provide a definitive report on the primary storms that affected the North Atlantic and North Pacific Oceans. The monster of the month is a title given to an extratropical system that may have been particularly dangerous. Unless otherwise stated, all winds are sustained and not gusts; all times are G.M.T.

North Atlantic Weather Log
October, November and December

the upper and lower Mississippi and Illinois Rivers and in St. Louis harbor came to a virtual standstill due to damage from flooding caused by heavy rains. This flooding left thousands homeless and shut down commercial barge and pleasure traffic in several areas of the Midwest.

On the Ile de la Gonave, an island north northwest of Port-au-Prince, Haiti disastrous flooding on the 23d killed at least 23 people, left 47 missing and forced thousands to flee their homes. The flooding was triggered by torrential rains.

A storm that swept across the North Sea and into northwestern Europe on the 20th caused some shipping problems, as mentioned in the casualty section. In addition, winds up to 90 mph swept through Germany and caused damage estimated in the millions of dollars.

Hundreds of trees were uprooted, houses were unroofed and electricity was interrupted in several communities. In East Germany the 90-mph gusts knocked freight containers onto railroad tracks.

Born in the Gulf of Alaska on the 1st, this storm survived a 5-day trans - Canadian journey and came into its prime in the North Atlantic. On the 7th it moved off Nova Scotia as its central pressure dropped below 990 mb. Heading toward Iceland it continued to intensify. By the 9th pressure had dropped to an incredible 956 mb, around a center that had just crossed the 60th parallel at 30°W (fig 2). Ships in the vicinity were reporting winds of 40 to 50 kn. The PASSAT (53°N, 36°W), at 1200 on the 9th, hit westerlies blowing at 52 kn. Swells were running 26 ft with a slope of about 1/50 (H/L). The system moved north of

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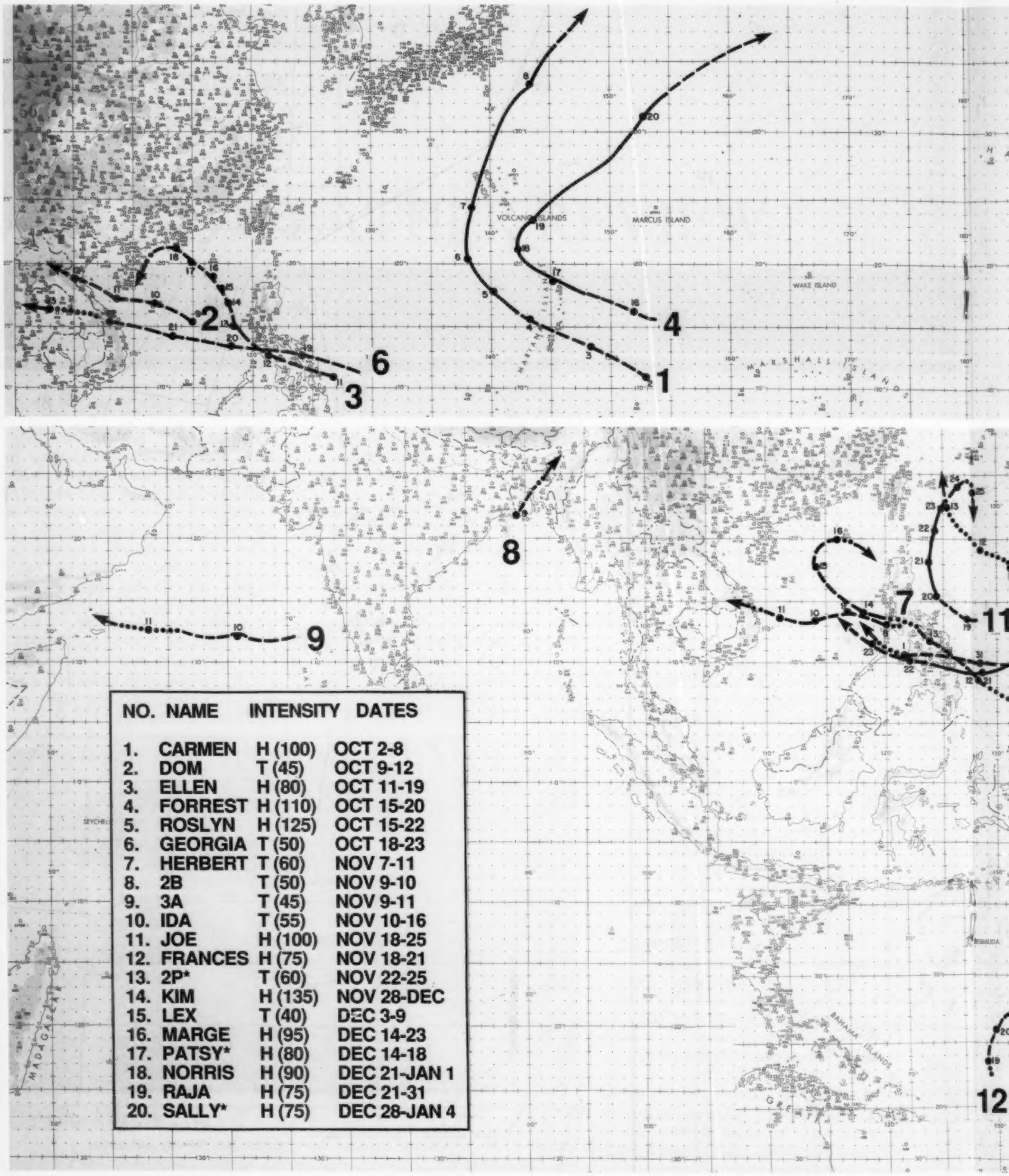
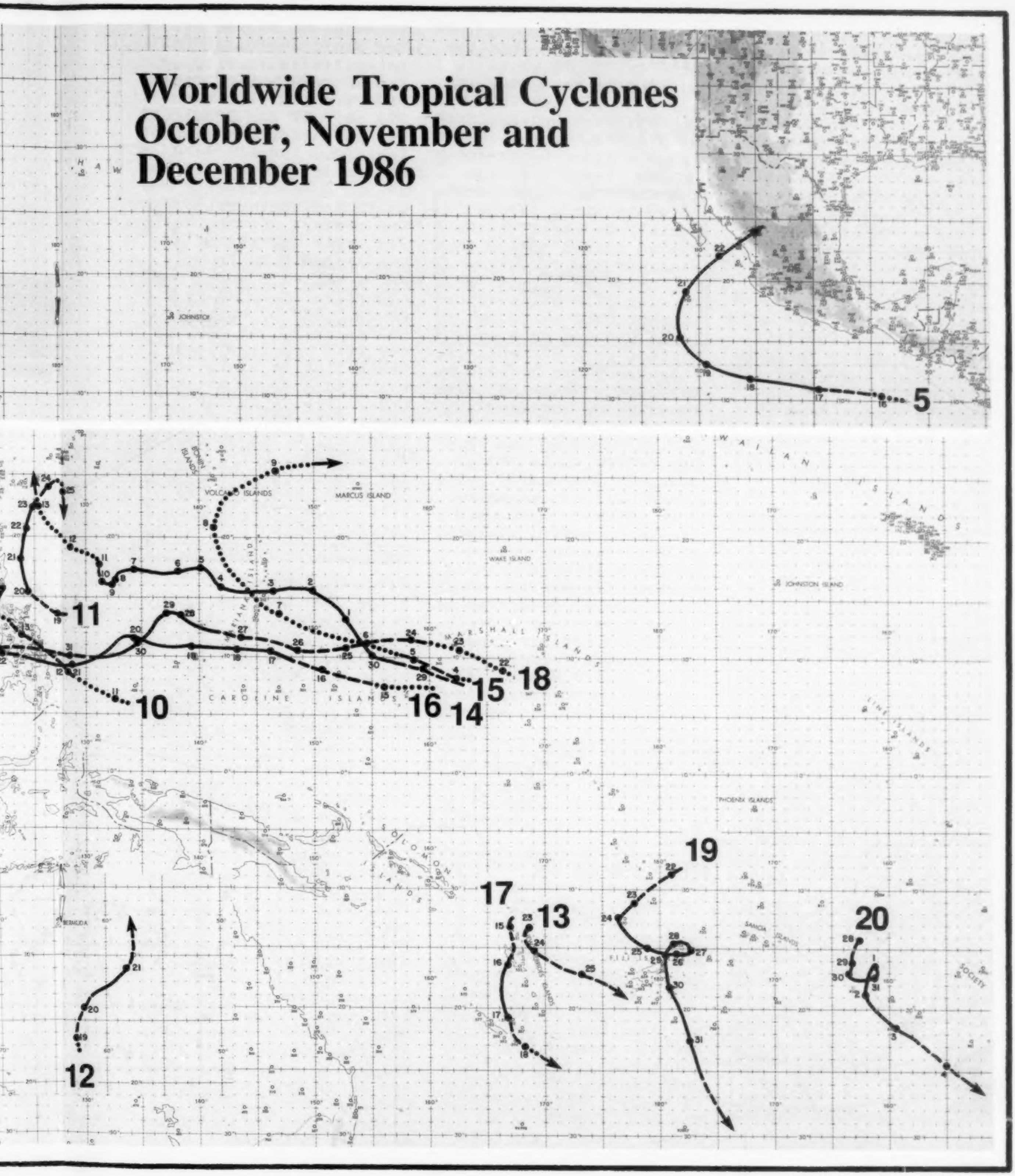
Figure 2. -- The circulation of this huge storm reaches into Norway and across Great Britan on the 9th.



NO.	NAME	INTENSITY	DATES
1.	CARMEN	H (100)	OCT 2-8
2.	DOM	T (45)	OCT 9-12
3.	ELLEN	H (80)	OCT 11-19
4.	FORREST	H (110)	OCT 15-20
5.	ROSLYN	H (125)	OCT 15-22
6.	GEORGIA	T (50)	OCT 18-23
7.	HERBERT	T (60)	NOV 7-11
8.	2B	T (50)	NOV 9-10
9.	3A	T (45)	NOV 9-11
10.	IDA	T (55)	NOV 10-16
11.	JOE	H (100)	NOV 18-25
12.	FRANCES	H (75)	NOV 18-21
13.	2P*	T (60)	NOV 22-25
14.	KIM	H (135)	NOV 28-DEC
15.	LEX	T (40)	DEC 3-9
16.	MARGE	H (95)	DEC 14-23
17.	PATSY*	H (80)	DEC 14-18
18.	NORRIS	H (90)	DEC 21-JAN 1
19.	RAJA	H (75)	DEC 21-31
20.	SALLY*	H (75)	DEC 28-JAN 4

Worldwide Tropical Cyclones October, November and December 1986



Iceland the following day. The NUNGU ITTUK was located east of Kap Farvel and sailing eastward when she ran into the storm on the 10th and 11th. At 1200 and 1800 on the 10th she hit 37-kn winds out of the southwest to west southwest. The following day she picked up to 52 kn in 20-ft seas. They remained at this level throughout the day it were substaniated by vessels such as the AKRANES. The storm's influence spread to north of Scotland where the EYRARFOSS and the JOHAN PETERSEN encountered a 52-kn blow on the 12th. By this time the storm, while remaining potent, was heading toward Spitsbergen.

While the previous storm was heading toward the Arctic Ocean this LOW was coming to life over Newfoundland. By the 16th its 972-mb center was passing south and east of Kap Farvel and heading into the Denmark St. The day before the SIR ROBERT BOND encountered 55-kn east southeasterlies near 52°N, 55°W. Other vessels like the CANADIAN LEADER, JAMES SINCLAIR and the VOCZ reported 35- to 40-kn winds farther south. On the 17th the system turned toward the east and the following day pressure fell to 960 mb (fig 3). Ships across the northern shipping lanes between 40°W and England were encountering rough weather. At 1200 on the 18th 40-kn winds were reported by the ENSOR, MOBILE BRILLANT and the ACHILLES, among others. The ARCTIC, some 400 mi south of the center, hit 50-kn west northwesterlies in 23-ft seas with swells estimated at about 46 ft. The huge storm system dominated the weather picture for the next couple of days as it moved slowly northeastward then recurved back toward Greenland. Gales were common from the English Channel and North Sea to just east of Nova Scotia. By the 22d the storm began to fill as it moved into the Denmark St, from the north, almost completing a large counterclockwise loop.

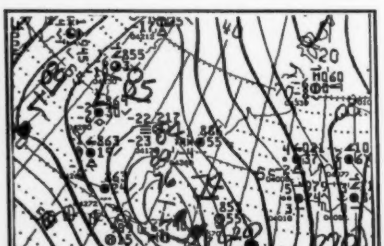


Figure 3. -- Late on the 16th central pressure read 974 mb.

While the previous system was tarrying north of Iceland, on the 21st, this soon-to-be Atlantic storm was coming to life on the other side of the North American continent. It was first detected on the 21st near 45°N, 140°W. After moving northward into British Columbia and the Yukon, it headed eastward. On the 25th, sporting a 980-mb center, the LOW moved Labrador Sea through the Hudson St. The storm continued to intensify as it clipped Kap Farvel on the 27th; pressure had fallen to 974 mb. By the 29th the 968-mb center was east of Iceland. Vessels were encountering winds in the 35- to 45-kn range to the south and southwest of the center. In the North Sea, with the aid of an associated cold front, ships and rigs were reporting 35-to 40-kn winds. OSV L, on station (57°N, 20°W), at 0100 on the 29th reported 44-kn westerlies in 21-ft seas that had a slope of about 1/30. The VALENTINE SEROV 1 hr before (57°N, 18°W) hit 47-kn southwesterlies. During the day the storm turned northward and began to fill. Its influence on shipping began to abate.

Tropical Cyclones -- Since 1931 some 98 tropical cyclones, 51 of which became hurricanes, have developed during this month. However, this season there were none, unlike the previous year when one hurricane and one tropical storm came to life.

Casualties -- A barge under tow of the tug MISS JEAN allegedly encountered heavy weather off Charles-ton, SC, on the 11th. The tug cast off the tow and the forward section of the barge sank while the aft section was eventually recovered. A storm late in the month created some problems in northwestern Europe. The GOLDEN COAST, Nantes for Antwerp, grounded on the 20th, off Terneuzen. She was later refloated. The ESSO SAINT PETERSBURG also heading for Antwerp struck a quay wall, sustaining damage on the

20th. On the 21st the MARINE EVANGELINE, on her regular voyage from Dieppe to Newhaven was hit by waves of 25 to 30 ft, about 1½ mi off Newhaven, causing the cargo to shift; some damage was noted after the vessel berthed safely.

November, 1986--A deep Icelandic Low, of 989 mb, reflected the abundance of cyclonic activity across the northern shipping lanes. This is 14 mb lower than normal. Along with a 1028-mb Azores High (+8mb), the low created a tight pressure gradient from Nova Scotia to Norway (fig 4). This was even more apparent in the 700-mb steering level, which indicated storm paths from northern North America to England.

On this Date--November 11, 1968-- A severe coastal storm produced high winds and record, early snows from Georgia to Maine. Known as the Veterans Day storm, winds reached 90 mph in Massachusetts and 10 in of snow fell over interior Maine.

Extratropical Cyclones -- The alley between a strong Icleandic Low and Azores High was followed by most of this month's storms to the chagrin of vessels that use the northern shipping lanes. These storms also devastated a trans-atlantic yacht race. One storm on the 21st brought an early winter to northern Maine and gales from the mid Atlantic to New England. Caribou, ME received 21 in of snow in 24 hr. Winds of 25 to 35 mph along with temperatures in the 20's (°F) produced wind chill readings below zero in New England. Mt. Washington, NH recorded winds in excess of 100 mph.

Monster of the Month -- On the 6th, a wave developed off the coast of New Jersey. It headed east northeastward across the Atlantic. By the 8th, near 47°N, 40°W, it became an intense storm as pressure dropped to 968 mb. Ships in the vicinity were reporting gale force winds. The DART BRITAIN (45°N, 39°W) encountered 60-kn southwesterlies in 13-ft seas. At 1200 on the 8th, some 12-hr later, the FARLAND (48°N, 32°W) was rocked by 68-kn southwest winds driving 50-ft seas; the slope was estimated at 1/5 --extremely steep. The vessel recorded a 976-mb pressure. A short distance away the NEDLLOYD ROSARIO confirmed these severe conditions as she encountered 63-kn winds in 46-ft seas. By the 9th central pressure was down to 960 mb and the eastern Atlantic from Spain to Norway was caught in the storm's grip (fig 5).

This was most unfortunate because the 9th was the start of the Route du Rhum, a transatlantic yacht race from St. Malo to Guadeloupe. The storm's effects were devasting. Within 20 min of the race start, the catamaran LADA POCH was dismasted. This was followed by the capsizing of the multihull FNAC. The first night the NEMS LUANK and APRICOT, both suffered extensive damage in collisions. This storm continued to plague the race and shipping in general as it moved through the Shetland Is

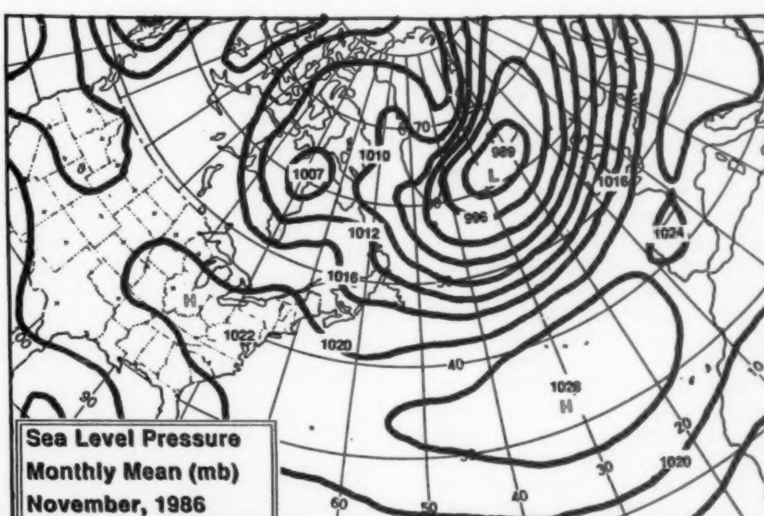


Figure 4. -- A November that featured a 989-mb Icelandic Low.

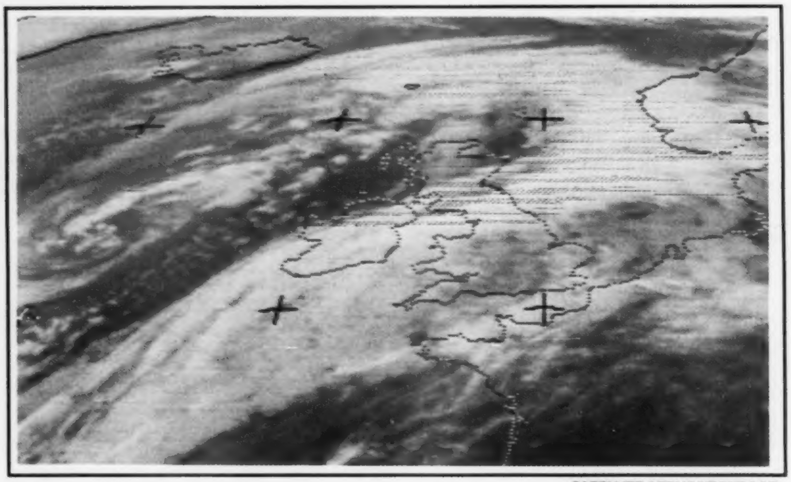


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Figure 5. -- Reminiscent of a storm last month, with its circulation sweeping over Norway and Great Britan (Nov 9, at 1400).

and into Norway on the 10th and 11th. Merchant vessels in the race area were reporting 35- to 45-kn winds in 10- to 20-ft seas on the 9th. The passing of this monster brought little relief to the race participants.

This system was born over Wyoming back on the 6th. It also was to have a profound influence on the transatlantic race. It came off the coast of Labrador on the 10th as a 982-mb Low. By the 13th, near 58°N, 16°W, it was a potent 960-mb cyclone, whose influence extended to 35°N, over most of the eastern North Atlantic. For example the NAVARINE near 40°N, 23°W (0000) encountered 43-kn westerlies in 23-ft seas. At the same time the MAGNUS JENSEN (61°N, 37°W) hit a 50-kn blow in 30-ft seas. Six hr later the MAAGEN new 62°N, 7°W was blasted by 58-kn southerlies. Race participants continued to have their problems. On the 12th the COTE D'OR began to disintergrate in high seas off Cape Finisterre. Waves were estimated at 30 ft. The two crewman were rescued. The APRICOT, a trimaran, was driven aground but the skipper was able to jump to some rocks and escape. Both the JEAN STALAVEN and ROYALE capsized and one seaman was listed as missing. Five vessels were forced to return to port for repairs and three others stopped in the Azores.

This system, which developed early on the 15th, enveloped the previous storm. So over the mid North Atlantic the gales continued. This was testified to by ships like OSV C, SEALAND DEVELOPER and BRITISH STEEL. These vessels along with the APRAPAHO were caught in a squeeze between the storm and a 1039-mb HIGH to the southwest. The ARAPAHO hit 55-kn winds in 23-ft seas at 1200 on the 16th; these conditions continued for at least 6 hr. The center at this time had actually filled from a 950-mb reading on the 15th to the 960-mb reading at 1200 on the 16th. However, the tight pressure gradient and large size of the system continued to create problems for several more days, as the system moved northeastward.

This storm also came to life on the 8th north of Hawaii. After moving northward through the Gulf of Alaska it swept down into the lower U.S. on the 17th and exited 2 days later over New

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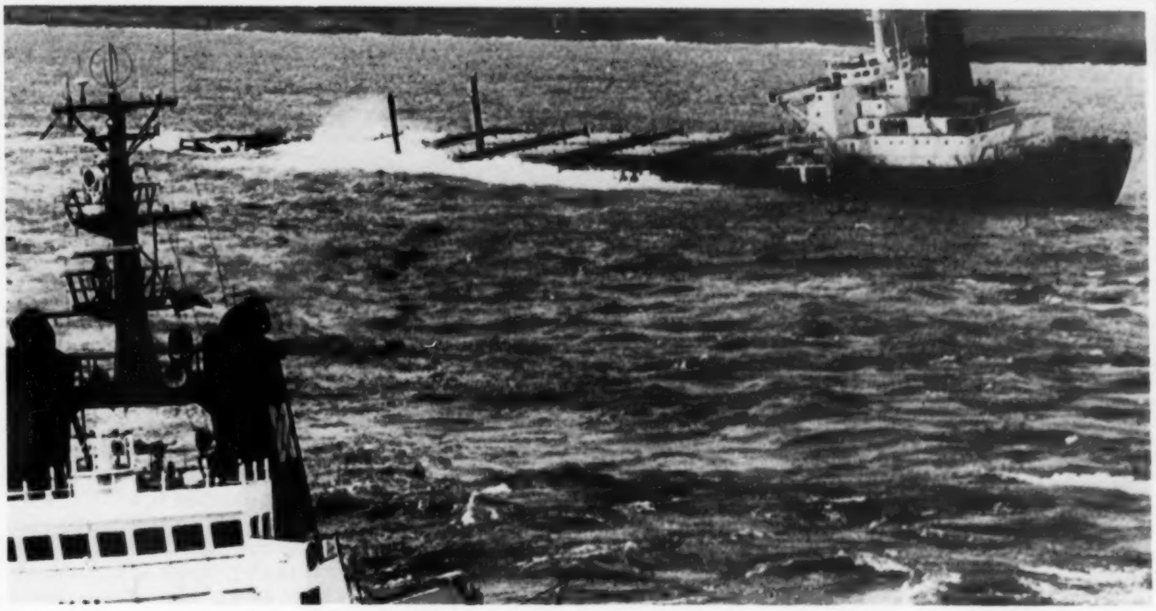
Figure 6. -- An old familiar pattern at 0600 on the 22d.



WIDE WORLD

Figure 7. -- For several days a sea- going tug attempted to free the KOWLOON BRIDGE from StagRocks off the Irish coast, with no success.

Jersey. By this time the central pressure had dropped to 986 mb and the system was beginning to affect shipping. At 1200 the ELDU 4 some 575 mi to the southeast of the center ran into 40-kn southerlies. Swinging northeastward the storm continued to intensify. By the 20th the 970-mb center was near 53°N, 35°W. Both the MELTON CHALLENGER and the VSBV 6 hit 40-kn winds; the latter encountered 30-ft swells on the 21st at 0000. The system peaked on the 22d (fig 6) when its pressure fell to 950 mb near 59°N, 13°W. The waters off the English coast were being clobbered. OSV L (56°N, 17°W) recorded 61-kn winds in 31-ft seas with a slope of about 1/3 --very steep; they also measured a 962-mb pressure at 1100. The DRUPA (61°N, 2°E) hit 60-kn winds in 16-ft seas. During the night of the 22d the KOWLOON BRIDGE was driven agound on Stags Rock off Ireland's southwest coast, after losing her steering in gale force winds, (fig 7). Winds of 35 to 50 kn continued into the 23d as the system began to weaken and head northward.

Tropical Cyclones -- Since 1931, some 23 tropical cyclones have developed over the Atlantic during this month; 13 have become hurricanes. This year Frances became the third November hurricane in the past 3 yr. The origin Frances was detected on the 15th north of the Lesser Antilles. On the 17th, a circulation was found and by the 19th the VLADIR ILYICH encountered 35-kn winds in heavy rain, near 23°N, 61°W. On the 20th Frances became a hurricane about 400 mi southeast of Bermuda. Maximum winds were estimated at 75 kn. Frances accelerated toward the northeast and dissipated on the 21st as it merged with an extratropical low pressure system.

Casualties -- The KOWLOON BRIDGE, which ran aground on the 22d, (as described earlier) could not be salvaged due to its poor location and continued bad weather. The casualties during a transatlantic yacht race are described under the monster of the month. The cargo ship FIONE was almost abandoned after running into a late month storm. She arrived at Tyne Dock, South Shields with a 22 degree list to port caused by shifting timber. The Dutch weather ship CUMULUS went to her aid during the storm. The FEDERAL SCHELDE, from Toledo arrived in Antwerp on the 17th with reported heavy weather damage.

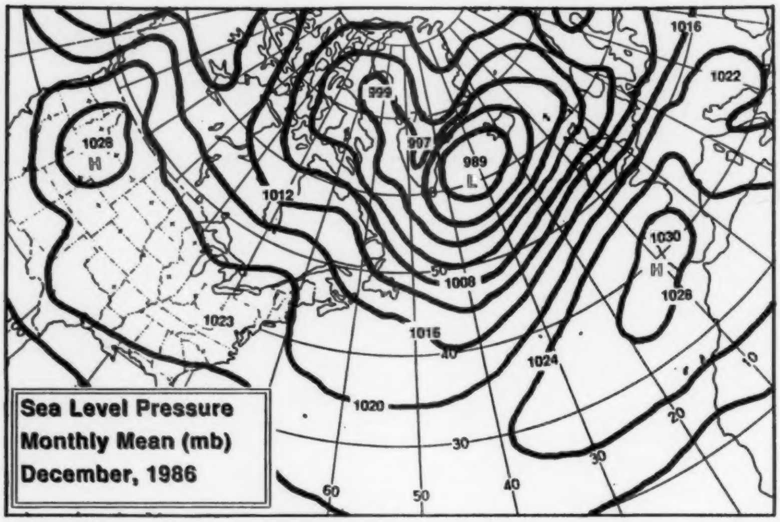


Figure 8. -- The Icelandic Low is a reflection of the monsters that haunted the shipping lanes this month.

December,1986 -- It was the worst of times, period. The Icelandic Low was lower than normal the Azores High was higher than normal and that spells trouble (fig 8). That strong gradient from Newfoundland to western Europe reflects the rough weather that occurred over the shipping lanes. The Icelandic Low boosted by a monster storm, on the 15th, ended up 13 mb below its normal pressure while the Azores High was 12 mb above normal. These features were reflected at 700 mb.

On this date -- December 16, 1835 -- New England experienced one of their coldest days of record. At noon on that bitterly cold Wednesday it was -40°F at Boston MA and -17°F at Hanover NH. Gales prevailed throughout much of the northeast and that night a great New York City fire destroyed much of the Financial District.

Extratropical Cyclones -- For the most part they followed the 700 - mb steering current and swept across the northern shipping lanes between Nova Scotia and northern England.

Early in the month a North Atlantic storm swept through the Gulf of Finland. It generated a storm surge in the Neva River delta and caused the worst flooding in Leningrad in 16 yr. On the 6th the Neva River rose nearly 8 ft above normal. On the 19th a LOW east of Cape Cod, and moving away from the U.S., generated strong winds from the mid Atlantic Coast to eastern New England. Nantucket, MA clocked gusts of 69 mph while Otis AFB (Falmonth MA) observed winds of 56 mph. Gusts hit 63 mph at Boston and 64 mph at Farmingdale, N.Y. Farther inland snow up to 30 in was recorded. On the 19th a Baltic Sea storm generated rough weather over East and West Germany. Winds up to 100 kn in West Germany, tore off roofs, smashed windows and uprooted trees. Storm tide warnings were broadcast for the north German coast. At least five people died on icy roads. Torrential rains driven by gales caused high water along the Rivers Moselle and Neckar, both tributaries of the Rhine, causing shipping to be suspended for 2 days. At the end of the month another snowstorm east of Cape Cod generated gales from North Carolina to New England. Combined with unusually high astronomical tides, flooding was observed in many areas.

Monster of the Month -- This may be the monster of the decade. It originated on the 13th in the Gulf of St. Lawrence. It was the last storm in a trio of potent LOW's that dominated the weather from about the 9th through the 18th. It is unlikely that three stronger storms ever enveloped an area in so short a time.

To set the scene it is best to take this trio chronologically. On the 7th the first LOW was just coming to life over the eastern shore of Hudson Bay. At the time just south of Iceland, perhaps a harbinger of things to come, another storm system had deepened dramatically to 956 mb -- a good winter storm. The

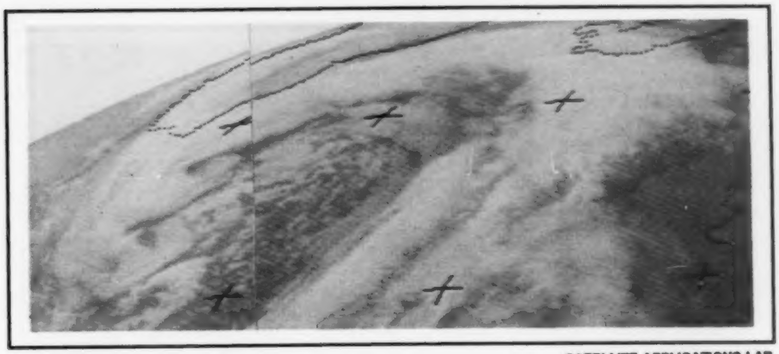


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Figure 9. -- The 952-mb storm and its huge circulation at 2230 on the 9th.

Hudson Bay storm swung southeastward, then eastward and came off the coast of Quebec as a 988-mb LOW on the 8th. It then began to track east northeastward and intensify. At 1200 on the 9th central pressure was down to 952 mb (fig 9). Storm and hurricane force winds were radioed in. The DAISHU MARU (46°N, 60°W) reported west northwest winds at 78 kn, the VSBB (47°N, 60°W) had 75-kn westerlies while the ATLANTIC CONVEYOR clocked 70-kn winds in swells estimated at 50 ft near 48°N, 45°W, Winds of 60 to 65 kn were reported by the CG29 and VSBC. At 1800 the VSBC estimated seas at 38 ft, with a slope of about 1/7. At 0100 on the 10th OSV C (52°N, 36°W) reported 60-kn west northwesterlies, while 1 hr earlier the CRYOS (44°N, 32°W, ran into a 78-kn northwest blow in 33-ft swells. Gradually conditions began to improve as the still potent system headed northeastward on the 11th.

However, the second storm had already formed on the 10th, east of Long Island. By the 11th (1200) its central pressure was at 980 mb near 51°N, 43°W; it was being reinforced by another LOW from Canada. The system moved to near 20°W, on the 12th, before it recurved. Pressure at 1200 was down to 956 mb -- a drop of 24 mb in 24hr. Winds in the 40-to 60-kn range were common. Swells were running up to 40 ft south of the storm center. Reports of 60 kn came in from the ATLANTIC SONG, FREYBURG, SUDURLAND, H046 and the VPGU. The low continued in a counterclockwise loop; by 1200 on the 13th its central pressure had dropped to 942 mb -- a monster in its own right (fig 10). Six hr before the VALENTINE SEROV (62.2°N, 26.5°W) reported a pressure of 953.3 mb; this was important in establishing the severity of this storm. This Russian vessel was to play an even more important role 2 days later. At 1200 the MAGNUS JENSEN (59°N, 43°W) encountered 60-kn westerlies in 33-ft seas with a 973-mb pressure. Six hr later, still on the 13th, they were reporting a 968-mb pressure in 60-kn winds and 16-ft seas.

Meanwhile an innocuous looking system was developing over Newfoundland. It's central pressure at 1200 on the 13th was 986 mb and it was dwarfed by the powerful storm in the Denmark St. However, 12 hr later it was down to 968 mb and looking a little more respectable. South of its center the TADEUSZ KOSCIUSZKO encountered 56-kn southwesterlies, ahead of the associated cold front. Behind the front the CRYOS, who encountered all the storms, ran into 58-kn winds. The lowest reported pressure at 0600 was from the reliable OSV C and was 959.2mb at 52.7°N, 35.5°W. This was about 100 mi south of the center. By 1200 on the 14th it was evident that something big was happening. The GODAFOSS near 56.1°N, 29.3°W, less than 100 mi from the

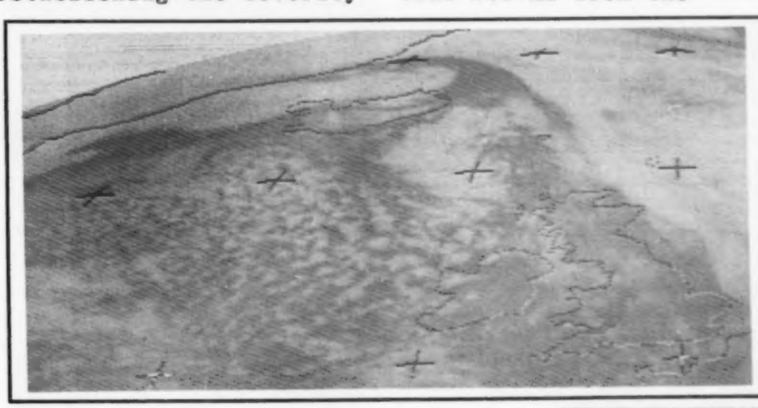

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Figure 10. -- The second of the trio on the 13th.

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Figure 11. -- Near peak intensity, this IR photo (2330 on the 14th), reveals one of the most potent extratropical storms on record.

center, reported 938.8 mb. This was more important than the 60-kn wind. The pressure at the center was estimated at 928 mb one of the most potent Atlantic storms in history. But it was not finished. At 1800 on the 14th, the HOFSJOEKULL 59.9°N, 38.6°W recorded a 928.9 mb. The VALENTINE SEROV, 61.7°N, 33.5°W, reported 928.2 mb. Several ships in the area were encountering 60 to 68 kn winds. The VALENTINE SEROV came in with a 920.2 - mb reading at 0000 on the 15th, near 61.1°N, 36.3°W. The British Meteorological Office assessed the central pressure at 916 mb wile the West Germans indicated a pressure as low as 912 mb. From this reading the National Weather Service estimated storm's central pressure at 900 mb. That is lower than the pressure for hurricane Camille -- 905 mb and just above the Labor Day Hurricane of 1935--892 mb. This extratropical system was one of the most intense in history (fig 11). At 0600, in 54-kn winds, OSV C was encountering 33-ft seas. Winds of 60 to 68 kn remained common. By 1200 on the 15th the storm's central pressure had risen to 932 mb and 12 hr later was up to 944 mb. Storm force winds were still being generated and to the east seas of 25 to 30 ft were reported into the 16th. The following day conditions finally returned to near normal. For more than a week the Icelandic Low was more than just a climatic feature -- it was enhanced to its maximum by a trio of potent storms.

Low Pressure Extremes

The lowest pressure anywhere was the 870 mb in typhoon Tip by the USAF on Oct 12, 1979. The Dutch steamship SAPOEROEA recorded 886.8 mb east of Luzon on Aug 18, 1927. Outside the tropics 942 mb was observed on South Georgia Is.

Tropical Cyclones -- Since 1931 just four tropical cyclones have developed over the Atlantic; two of these became hurricanes. None came to life this year.

Casualties -- On the 2d the VILLON, Trelleborg for Stugsund, developed a 35° list in 60-kn winds some 9 mi northeast of Simrishamn. The crew of three were saved by the Swedish rescue vessel WILH. R. LUNDGREN before the VILLON sank. Several vessels off Norway had trouble on the 1st and 2d. The BLACK SEA had to be abandoned 17 mi northwest of Svinoy. The SUFFOLK CONQUEST (58°N, 1°E) reported wheelhouse stove in by large wave. On the 1st the DIMPLE grounded near Skaareskage. In Copenhagen harbor the WINSTON CHURCHILL and the KOMSOMOLSK were torn from their moorings. On the other side of the Atlantic the CHESAPEAKE sustained heavy weather damage on the 1st and 2d on a voyage from St. Croix to Cape Henry, VA. In the worst tragedy of the month, the 3,500 - ton Icelandic freighter SUDURLAND went down on Christmas Eve, halfway between Iceland and Norway, in heavy seas. Five were rescued by a Danish Coast Guard helicopter. However three crewmen died in the lifedraft and three others went down with the vessel. Late in the month the HADIR M sank in heavy seas off Alexandria, Egypt.

MARINE WEATHER REVIEW (cont'd)

North Pacific Weather Log
October, November and December

October 1986 -- Autumn arrived in typical fashion over the North Pacific Ocean, with extratropical and tropical activity in full swing. The major departure from normal was the displacement of the Aleutian Low and its Kamchatka extension, southward. (fig 1). This along with lower than normal pressures over the Kamchatka Peninsula, resulted in negative anomalies to the tune of 5 to 6 mb, just southeast of the peninsula and south of the Alaska Peninsula. This was reflected by the storm tracks for the month and the 700-mb steering level, which was nearly zonal across the Pacific; there was noticeable troughing and an northeastward curvature in the northeast and over the Gulf of Alaska.

On this date -- October 21, 1934 -- A severe windstorm lashed the North Pacific Coast. In Washington 22 people were killed. The storm caused $1.7 million damage, mostly to timber. Winds reached 87 mph at North Head, WA and waves were more than 20 ft high, even in Puget Sound and Lake Washington.

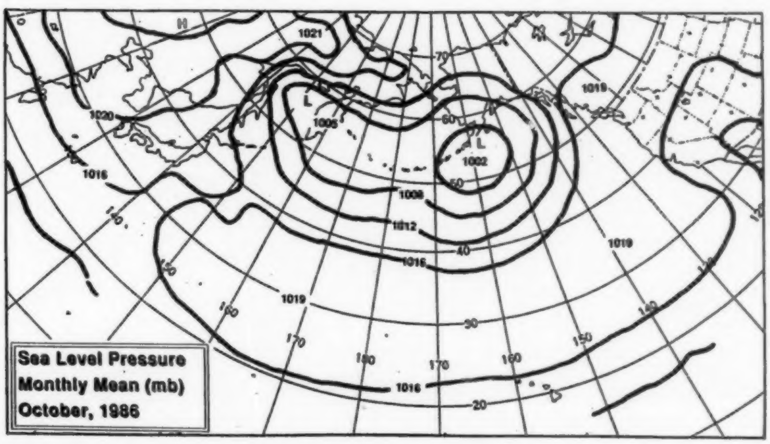

Figure 1. -- Near normal conditions prevail across the Pacific.

Extratropical Cyclones -- The first reported storm of the month caused some problems in the Seward, AK area on the 10th. Strong winds, heavy rains and high tides were responsible for damage estimated at about $21 million. It wasn't until the 24th that the Alaska Railroad was restored to operation. Toward the end of the month the island of Sumatra was devasted by floods and landslides triggered by torrential rains. At least 74 people were killed and 22 were missing from the flooding that cut off more than 20 thousand people in the southern province of Lampung.

East of Tokyo on the 5th a small wave developed along a stationary front. Moving east northeastward, it didn't make much of an impact until after crossing the Dateline on the 8th. Pressure dropped to 980 mb and vessels such as the

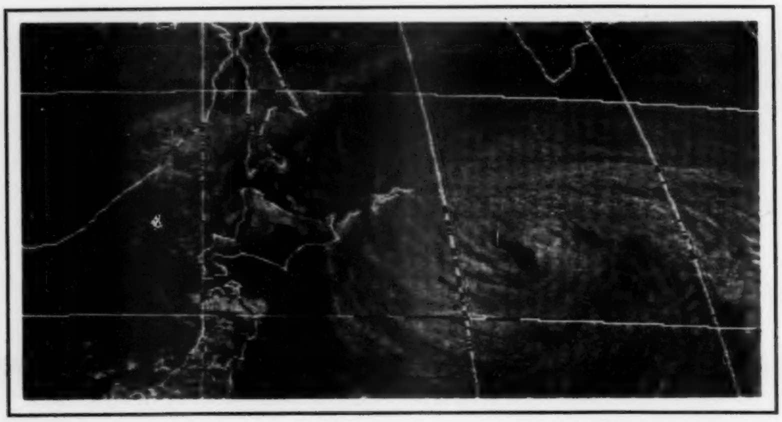

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Figure 2. -- Remnants of typhoon Carmen produce a tight gradient with the storm near the Gulf of Alaska on the 9th.

PRESIDENT TRUMAN, RIVER STAR and the ELFN reported winds in the 35-to 45-kn range. The storm's circulation was enhanced by typhoon Carmen, which was now east of Tokyo. Central pressure dropped to 978 mb on the 9th as the system turned northward toward the Alaska Peninsula (fig 2). At 1800 the PRESIDENT TRUMAN (49°N, 153°W) ran into 48-kn southeasterlies in 8-ft swells, while the SEALAND MARINER (52°N, 155°W) reported 20-ft seas with a slope of about 1/10. The following day the storm moved into Alaska. It did manage to survive landfall and after a trek across the Northwest Territory it arrived as a 977-mb LOW over Greenland on the 14th.

Meanwhile, by the time Carmen crossed the 40th parallel on the 8th, it was beginning to turn extratropical. By the 9th it was vicious 962 -mb system disrupting shipping over the western North Pacific. The NEW INDEPENDENCE, at 0000 on the 10th, reported a 985 mb pressure, about 200 mi south of the center, in winds that reached 60 kn; seas this close were running about 12 ft. Six hr later the S. SILVIA (51° N, 174°E) encountered 50-kn easterlies in 13-ft swells. The system turned eastward on the 11th and began to fill. The following day it moved up the Alaska Peninsula. On the 13th and 14th while continuing to weaken it did generate gales over the Gulf of Alaska.

Two late month storms developed in the western waters. They both remained potent into the first part of Nov. The first one came life over Kyushu on the 24th. This Japanese LOW moved eastward for several days as a relatively weak system. It wasn't until the 29th, after crossing the Dateline, that it began to intensify. Gales reports came in from a number of vessels including the POLER ACE, PEARL ACE and the SURUGA MARU. Seas were running 8 to 13 ft. One of the ELES ships (38°N, 171°W) encountered 50-kn northwesterlies, at 0600 on the 30th, in swells of 23ft; seas were running 20 ft with a slope of about 1/20.

By this time the second system was developing to the west, near 37°N, 150°E. By 1200 on the 31st the central pressure of this east northeastward moving storm was down to 972 mb and gales were occurring in all quadrants. The JINEI MARU, some 360 mi south southwest of the center, was blasted by 50-kn winds at 0900. The two storm systems brought Nov an auspicious start.

They combined into a complex double centered system on the 1st (fig 3). The second system's pressure had dropped to 955 mb. Ships as far as 700 mi to the southwest of this center were reporting gales. At 0300, on the 1st, the JNZM encounterd 54-kn westerlies near 44°N, 178°E; swells were running up to 20 ft. The following day the PRINCE OF TOKYO reported 40-kn winds in 12-ft seas with a slope of about 1/20.

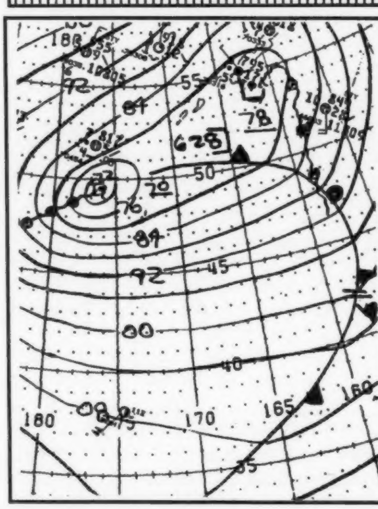

Figure 3. -- The double-centered storm at 1200 on Nov 1.

Tropical Cyclones -- Six tropical cyclones developed over the North Pacific. Only hurricane Roslyn (see article pg 7) roamed the eastern waters. In the west two typhoons and three tropical storms came to life. Five tropical cyclones is about average for the entire Pacific.

Carmen developed southeast of the Mariana Islands on the 2d. After crossing through the Islands, it reached typhoon strength early on the 4th. As Carmen began to recurve it continued to intensify. At 1800 on the 5th it reached a peak as winds roared at 100 kn. At 0600 on the 6th the PYATIDECYATILETIE SOVETSKO1 GROU221 (19°N, 146°E) encountered 39-kn north northeasterlies. This was typical as vessels remained well clear of Carmen's center. The typhoon accelerated northeastward but remained east of Japan. On the 9th it turned extratropical.

Dom was only a 45-kn tropical storm, but it passed through the Philippines as a tropical depression before intensifying over the Luzon. In Manila about 80 percent of the streets were under water, while government offices, schools and businesses shut down. Navy rescue teams plucked victims from rooftops as floodwaters rose to 7 ft in some areas. Rainfall totaled up to 24 in the metropolitan area. At least 200 people were killed and more than 11 thousand were forced to flee their homes.

Dom reached tropical storm strength on the 9th as winds climbed to 45 kn at 1200. The storm moved over northern Vietnam on the 11th.

While Dom was dying, Ellen was coming to life just off the coast of Samar in the Philippines. Moving west northwestward the tropical storm brought additional rainfall to the central and northern areas of the Islands. Ellen reached typhoon strength, on the 13th, in the South China Sea as it headed for Hong Kong. The following day maximum winds were estimated at 80 kn. On about the 16th the SAMUDRAGUPTA, allegedy, was damaged in heavy weather from the typhoon. During the this period several vessels checked in with strong winds. At 0000 on the 13th the GUANG HAI (18°N, 120°E) reported 52-kn northeasterlies, while nearby FOSSARUS encountered 16-ft seas. At 1800 the FICUS (17°N, 119°E) was battered by 54-kn southeasterlies. Six hr later her winds picked up to 60 kn, and swells gradually increased to 23 ft. At 0600 on the 15th the YJWM reported south southwesterlies at 60 kn near 18°N, 118°E; they estimated seas at near 50 ft with an approximate slope of 1/10. Before Ellen hit Hong Kong, it turned toward the west and dropped to tropical storm strength on the 17th (fig 4).

Forrest by the 17th had already reached typhoon intensity and was recurving through the northern Mariana Is. The typhoon winds hit an estimated 110 kn at 0600. The followind day the storm completed the parabolic pattern and

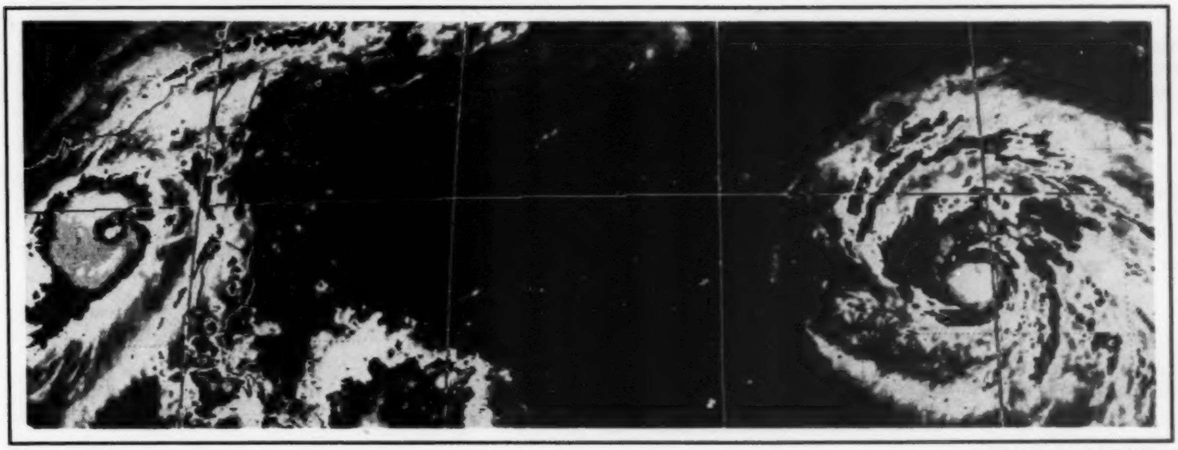

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Figure 4. -- Typhoons Ellen, in the South China Sea, and Forrest, in the Marianas, at 0900 on the 16th.

headed northeastward. The system maintained typhoon strength into the 20th parallel. On the 21st at 0000 the 3EJG (36°N, 161°E) encountered 40-kn northeasterlies in 15-ft seas. Forrest continued to generate gale force winds as it turned extratropical.

Georgia became the third tropical cyclone to affect the Philippines this month when it moved through the central islands on the 19th as a tropical storm. At 1800 on the 20th the CLOVER ACE (17°N, 113°E) hit 40-kn northeasterlies in 13-ft seas. Georgia's top winds were 50 kn on the 21st before it moved ashore over Vietnam.

Casualties -- On the 6th, at Manila the LONESTAR allegedly suffered damage during tropical storm DOM when four barges, nearby, broke loose and banged into her. On the 16th the SAMUDRAGUPTA, Paradip for Japan, ran into typhoon, Ellen and suffered damage. The tug GORDON GILL in tow of tug/icebreaker ORION EXPEDITOR, enroute from Dutch Harbor to San Diego, broke tow in heavy weather on the 22d, near 51°N, 161°W. Winds were 30 to 35 kn and swell was running 23 ft. The ORION EXPEDITOR made for Anchorage, AK for emergency repairs while a search was made for the missing tug.

November 1986 -- Weather patterns were relatively normal across the North Pacific. The largest departure was a +9 mb anomaly in the eastern Pacific subtropical high which, in addition to being stronger than normal, was centered north of its normal position (fig 5). The 700-mb pattern was zonal from Japan to about 170°W where it turned east northeastward and storms, during the month, tended to follow this current.

On this date -- November 7, 1940 -- The Galloping Gertie Bridge at Tacoma, WA collapsed in strong winds, resulting in a loss of $6 million, just 4 mo after the grand opening. Winds caused the evenly sized spans of the bridge to begin to vibrate until the central one finally collapsed. From then on bridges were constructed with spans of varying size.

Extratropical Cyclones -- Activity was spread out across the Pacific, both east-west and north-south. The strong subtropical high protected the West Coast of the U.S. for most of the month. Several storms moved through the Gulf of Alaska and the Bering Sea had its usual complement. One strong Atlantic storm had its origins just north of the Hawaiian Islands. Late in the month a storm system did affect the U. S. West Coast. On the 23d winds of 50 mph blew along the Washington coast and over northern Puget Sound. In Southern California winds gusted to more than 50 mph in several areas. The first couple of weeks a number of weak short-lived storms developed but, in general, conditions were fairly quiet. An indication of things to come, however, was seen in the tail end of a Bering Sea storm on the 13th and 14th. This system generated gales across its southern quadrant as it moved through the northern part of the sea and into Alaska.

On the 15th a wave developed along a stationary front near 30°N, 175°W. Circumventing a 1034-mb HIGH, it moved northeastward, then eastward over the next several days. It really was not much until about 1200 on the 17th when its pressure dropped to 980 mb. Then during the next 24 hr, as it approached Vancouver Is., the bottom dropped out as pressure fell to 958

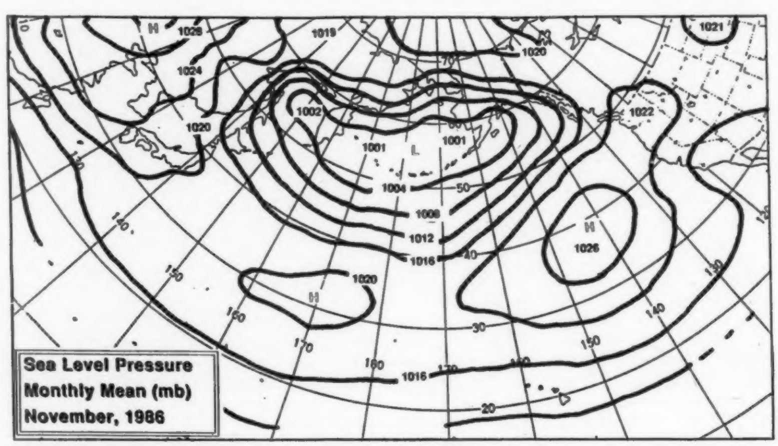

Figure 5. -- The subtropical high is an important feature this month.

mb (fig 6) The BOTSMAN MOCHKOV (48°N, 132°W) ran into 50-kn winds in 20-ft seas; at 1200; that was up from 43 kn, 12 hr before. The MOBIL MERIDIAN and a 3EHG vessel reported winds of 50 kn or more at 0000 on the 18th. At 0700 the BALTIMORE TRADER (53°N, 133°W) was blasted by 50-kn winds in 23-ft seas, with a slope of about 1/6 -- very steep. At 1800 the STOR reported 58-kn noth north northwesterlies and the PORT RESOLUTION hit 33-ft seas. By the 19th the storm had moved and weakened, but in its wake another system kept conditions rough for a few more days.

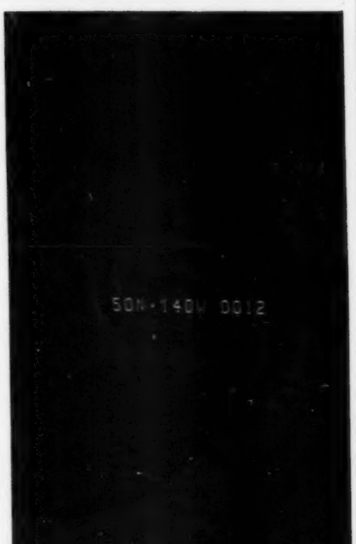

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Figure 6. -- The 958-mb LOW is moving toward Vancouver Is on the 18th.

This system came to life on the 23d near 43°N, 170°E. It was a small potent storm as it headed northeastward. As it approached the Gulf of Alaska its circulation grew. This was testified to by such vessels as the MANILA SUCCESS, WASHINGTON RAINBOW II, GREAT OCEAN and the SUMMERFIELD at 1800 on the 24th. They were reporting winds of 40 to 50 kn up to 800 mi from the storm's center. The SUMMERFIELD (50°N, 150°W) reported 52-kn winds in 30-ft seas. By 0000 on the 25th central pressure fell to 958 mb as the system was centered in the Northern Gulf. Reports of 35 to 50 kn were common and a few even exceeded that. The PHILADELPHIA (55°N, 135°W) encountered 60-kn southeasterlies in 20-ft swells while the LIPA measured 59-kn south southeasterlies in 20-ft seas. Late on the 25th the storm stalled and began to fill. It did however remain potent for another day.

While the previous storm was ravaging the Gulf of Alaska, on the 25th, the remnants of typhoon Joe were being recharged into a dangerous extratropical system. Joe became extratropical on the 24th, near Tokyo. It looked as though Joe was finished. However, once back into the friendly confines of the North Pacific the storm became a tiger. As it sped toward the northeast, central pressure plummeted. From 999 mb at 1200 on the 25th it fell to 978 mb, 24 hr later and to 950 mb by 1200 on the 27th. By this time the system was in the Bering Sea (fig 7). But its circulation extended beyond 40°N. In general winds over the northern shipping lanes were blowing at 35 to 50 kn. The AVATCHA (56°N, 172°E) encountered 50-kn northeasterlies in 16-ft seas; she also measured a 969-mb pressure at 1200. A short distance away the NDWA hit 48-kn southeasterlies. At this time the storm was intense enough, that had it been centered over the shipping lanes it would have qualified as monster of the month. After reaching this peak, on the 27th, it turned eastward and slowly began to fill. Winds of 50 to 60 kn were still being reported north of 50°N on the 28th. Seas as high as 33 ft were reported by the HYUN DAI 1, near 55°N, 158°W. the storm moved over southwest Alaska on the 29th.

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Figure 7. -- Extensive circulation of the Bering Sea storm at 0900 on the 27th.

It was about the time that the previous system was moving ashore that this seemingly insignificant storm was making an appearance over the Kamchatka Peninsula. It became another of those explosive systems. At 1200 on the 29th, central pressure was at 980 mb. During the next 24 hr it dropped 26 mb and was a potent system, covering the Bering Sea and influencing weather far to the south. Gales extended to 35°N (165°E to 175°E) as reported by the DAIEI MARU, CENTURY LEADER NO. 3, and PRESIDENT JEFFERSON. Closer to home (54°N, 172°W) the TATEKAWA MARU encountered 59-kn southerlies and the CG 29 hit 62-kn notherlies (53°N, 132°W). At 1800 the MYS IELAGUNIA (57°N, 172°E) hit 52-kn winds in 26-ft seas. The storm continued to pummel shipping into the next month. Winds of 35 to 45 kn were common. On the 1st the BLUE PINE hit 40-kn west southwesterlies more than 750 mi south southeast of the center. By late on the 1st the storm began to fill.

Tropical Cyclones -- Two typhoons and two tropical storms came to life this month, all in the western ocean; this activity is slightly above the average. Three of the storms affected the central Philippines.

Herbert popped up over Mindoro in the Philippines on the 7th. Over the South China Sea, winds reached 60 kn on the 9th. The PRIDNEPROVSK (19°N, 111°E) at 1200 on the 9th reported 43-kn northeasterlies in 12-ft seas. The storm continued westward and on the 11th moved ashore over Vietnam.

Tropical storm Ida, meanwhile, had developed south of Koror and was heading west northwestward. Ida crossed through the central Philippines on the 12th and 13th as a tropical storm. It reached a peak on the 15th after it was over the open South China Sea; maximum winds climbed to 55 kn. Winds in the 38 to 45 kn range were reported by the PEARL OF SCANDINAVIA, DA NING, EAST WIND and the FAN XIN; seas were running up to 23 ft. However Ida weakended and fell to depression strength the following day.

Typhoon Joe blew in on the 18th in the central Philippine Sea. It recurved before going ashore over the Philippine Is, but is circulation extended that far and it brushed Luzon as a typhoon on the 20th. Maximum winds hit 100 kn on the 21st. At 1800 on the 22d the JULIE A. (22°N, 121°E) reported 40-kn northerlies; these winds continued for the vessel into the 23d and she was running in 13-ft swells. Joe weakened on the 24th before reaching the Ryukyu Islands.

Supertyphoon Kim developed between the Caroline and Marshall Islands on the 28th. The storm quickly reached typhoon strength the following day. The typhoon headed northwestward and then westward. By the 2d winds near the center reached supertyphoon strength -- 130 kn. At this time the center was about 150 mi west of Saipan. By late on the 2d winds peaked out at 135 kn, sustained and early the following day Kim's Center moved very close to the Island.

Saipans's port area was particularly hard hit. Huge waves and strong winds beached ships, overturned containers and unroofed buildings. An estimated 1,000 homes were damaged, 280 of these destroyed. Power was lost for several days. Fortunately no lives were lost. Among the vessels beached was the 170-ft PETRO SERVICE with its cargo of 140 thousand gallons of gasoline. Luckily the hull and cargo remained secure until it could be refloated in January.

On the 3d at 1200 maximum winds dropped to 125 kn as Kim continued westward. The storm remained at typhoon strength through the 8th. As a tropical storm it turned toward the north and, on the 11th, dropped back to depression strength. Kim finished up as a depression on a northwestward course approaching the Ryukyu Is.

Casualties -- The casualties that were reported in the source material that we receive can be found in the text. On the whole few incidents that were weather related were reported this month in the North Pacific.

December, 1986 -- The Aleutian Low was the most dramatic feature over the Pacific. It usually is in this month, but its 979-mb center (fig 8) is 24 mb lower

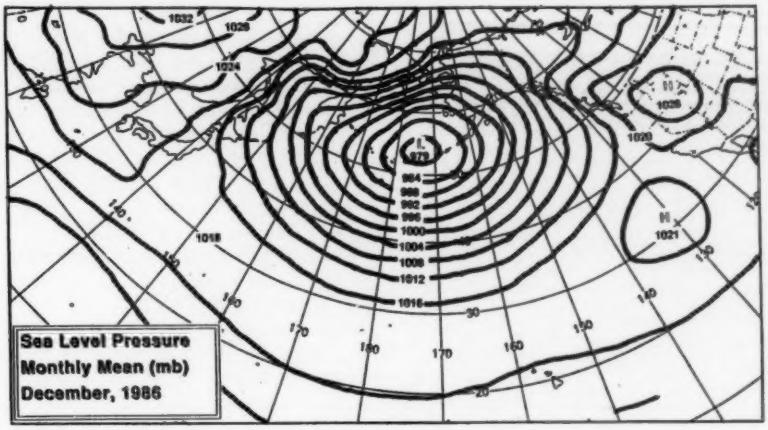

Figure 8. -- The Aleutian Low at its most spectacular.

than normal. It dominated the weather north of 40°N. This is a reflection of several deep storms that moved through the region. The 700-mb level looks like a reproduction of the surface picture and the maximum anomaly was -189 m.

On this date -- December 11, 1932 -- very cold weather prevailed along the West Coast. In San Francisco nearly an inch of snow was observed and the temperature at the airport dipped to 20°F.

Extratropical Cyclones -- Most of the storm activity was concentrated north of 40°N as indicated by the mean pressure chart. Most intense were storms just south of the Aleutians and several in the Gulf of Alaska.

This system came to life on the 6th, just east of North Korea. It moved close to the 40th parallel and intensified over the next 2 days. By the 8th central pressure was down to 968 mb and the LOW was beginning to swing towards the north. At 0000 on the 9th, the PRINCE OF TOKYO (42°N, 178°W) encountered 52-kn northwesterlies in 13-ft seas, while an ELES vessel, near 38°N, 180, also hit 52-kn winds. By 1200 on the 9th the storm reports. Pressure continued to fall and by 0000 on the 10th it was down to 942 mb (fig 9). Now the reports came in. The NNHB (55°N, 166°W) hit 55-kn southeasterlies and recorded a 965-mb pressure. The VALIANT I (47°N, 176°E) in 25-ft seas reported a 48-kn west wind. Gales continued to blow through the 10th.

On the 18th just west of Honshu, this storm got its start. Moving northeastward it strengthened and by the 20th, off the Kamchatka Peninsula, pressure was down to 962 mb. The following day a 958 mb center crossed the 165th meridan. The situation was complicated by another system to the east. Gales were being generated along the northern shipping lanes as testified to by such vessels as TROUBOTCHEVSK, SOVIETSKAIA BOURIATIYA, and the SAVU CAREER. Seas were running 8 to 15 ft. The system moved eastward and slowly began to fill. However, it was soon replaced by another more intense double-barrelled system.

Monsters of the Month -- These two storms joined forces on the 24th to affect shipping across a good portion of the Pacific. One storm came to life over 46°N, 163°E on the 22d while the other started early on the 24th near 46°N, 165°W. By 1200 on the 24th

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Figure 9. -- An Aleutian storm and its attendant circulation, on the 10th.

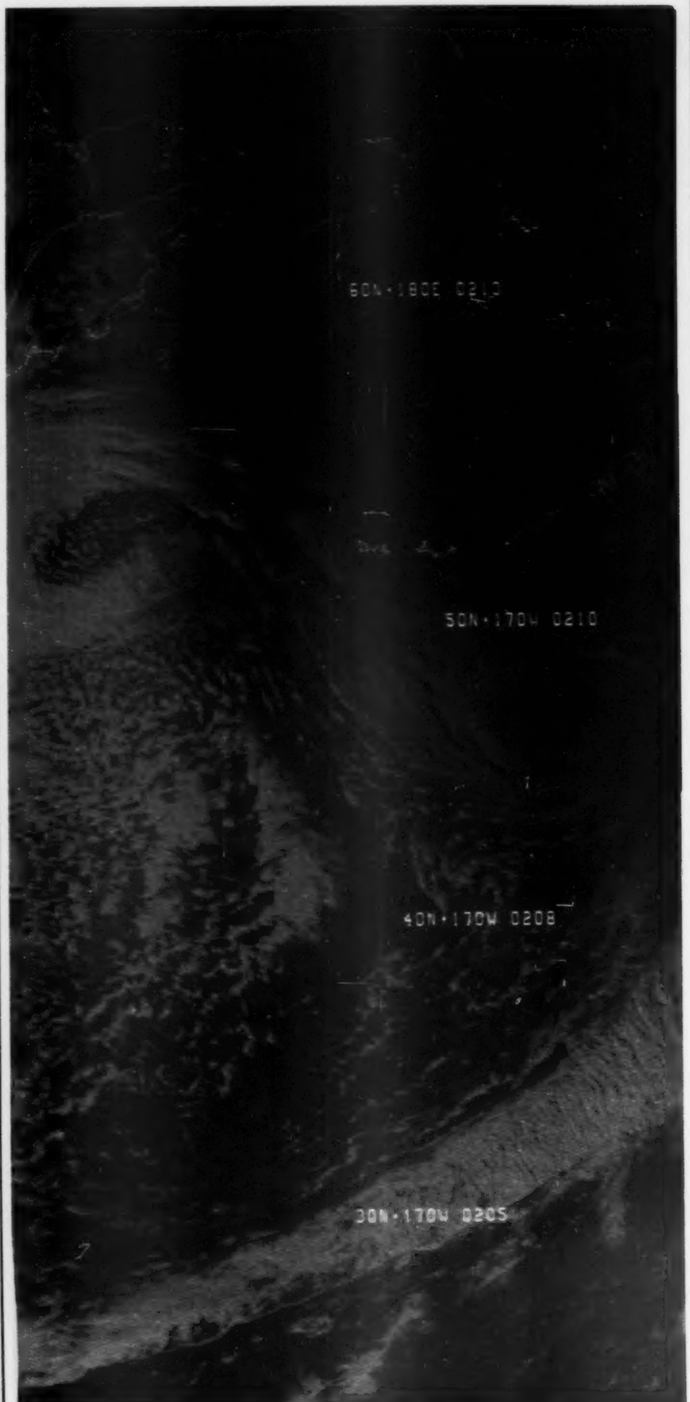

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Figure 10. -- The intertwined circulation of two monsters on the 24th.

(fig 10) central pressures were down to 956 mb and 954-mb respectively. Even on the 23d wind reports were ranging from 50 to 60 kn and seas up to 26 ft were being reported. The NEPTUNE PEARL hit 58-kn westerlies near 47°N, 164°E at 0600. Strongest winds were being generated from 35° to 50°N between 160°E and 150°W. At 0000 on the 24th several vessels ran into severe conditions. The 3ETP4 (44°N, 170°W) reported 60-kn westerlies in swells estimated at 43 ft. The X10 (38°N, 163°W) estimated winds at about 70 kn from the west. The PULSAR ahead of the easternmost storm ran into 50-kn easterlies near 42°N, 154°E. This storm was heading for the Gulf of Alaska while the western center was on an eastward course. By the 26th, their combined circulations extended from the Gulf of Alaska to near Marcus Is. Gales were generated over a wide area but the systems were beginning to weaken and another storm was waiting in the wings.

On the 26th a wave was developing along the stationary front of one of the pre-vious storms, near 40°N, 170°W. This system headed for the Gulf of Alaska and deepened rapidly. By the 27th, at 1200, its central pressure was down to 968 mb. Some 24 hr later the 957-mb LOW was dominating the Gulf and most of the eastern North Pacific (fig. 11). At 1800 on the 27th the LILAK ACE (49°N, 142°W) ran into 59-kn southerlies in 15-ft swells. The PROSPERERIDAD (52°W, 150°W) reported 50-kn northerlies with a 965-mb

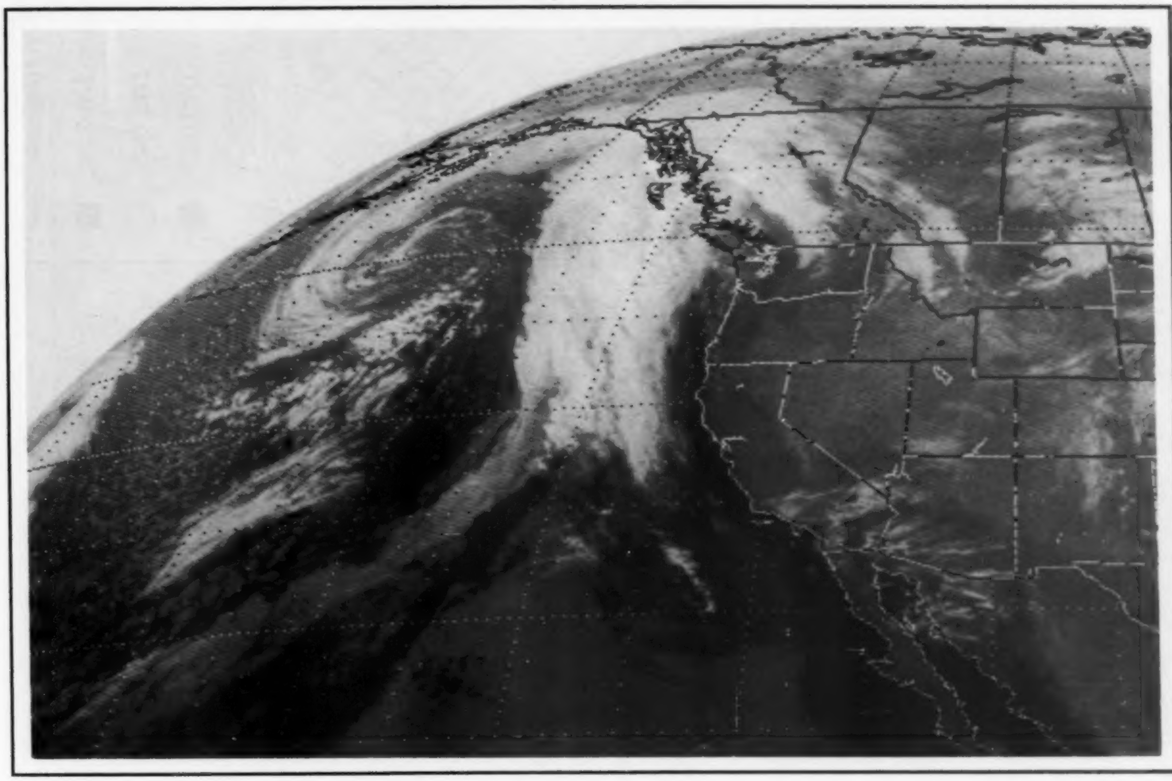

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Figure 11. -- The large Gulf of Alaska storm at 0532 on the 28th.

pressure in 18-ft swells, at 0000 on the 28th. As the LOW moved toward the Alaskan coast it began to weaken. It moved ashore on the 30th.

Tropical Cyclones -- Three tropical cyclones came to life in the Pacific; Marge and Norris were typhoons while Lex was a tropical storm. Usually one is expected.

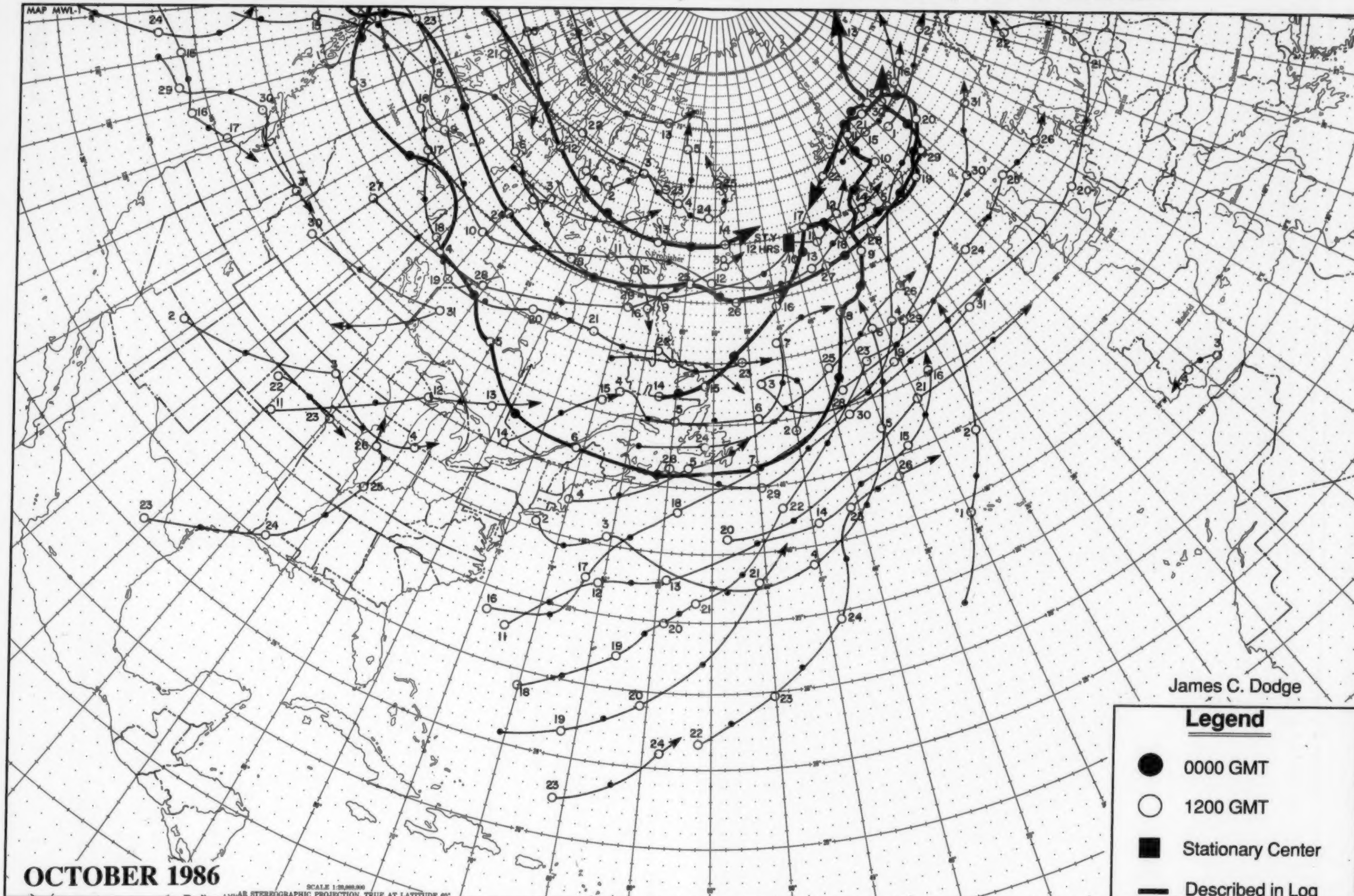
Tropical storm LEX developed over the Marshall Is; as did Marge and Norris. Lex became a tropical storm on the 4th and winds climbed to 40 kn. By 0600 on the 5th it was back to depression Lex recurved through the Marianas on the 7th.

One week later typhoon Marge came to life near where Lex had formed. However, Marge moved westward toward the Philippines. The storm reached typhoon strength on the 16th. The following day Marge passed about 150 mi south of Guam. Maximum winds reached 95 kn on the 20th and the following day the typhoon moved across Mindanao. The trek across the Philippines took its toll and Marge emerged in the South China as a tropical storm, on the 22d.

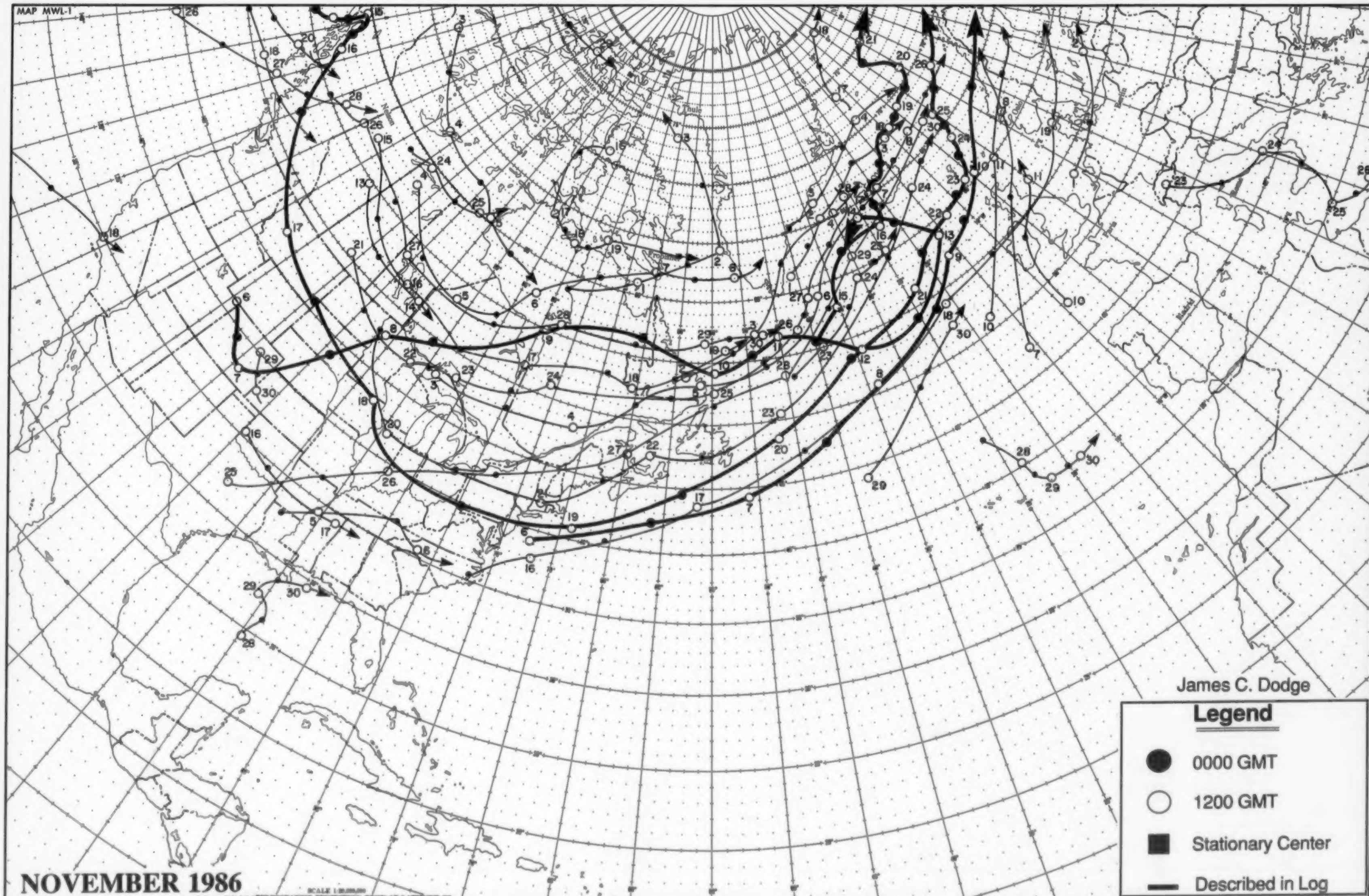
It was about this time, late on the 21st, that typhoon Norris was forming in the Marshall Is. Norris followed a path similar to that of Marge. The storm passed about 120 mi south of Guam on the 26th and reached typhoon intensity the following day. Norris'maximum winds reached 90 kn on the 29th. By the time it reached Mindanao, on the 31st, winds has dropped back to tropical storm strength. Norris emerged from its trek through the Philippines as a tropical depression.

Casualties -- The TOROS BAY, Moji, Japan to Anewa Bay, Solomon Is., grounded on the 22d. The DONA LAUREL, cargo carrier built in 1970, on a voyage from Bangkok proceeded to Hong Kong although she developed a 20° list in heavy seas on the 11th.

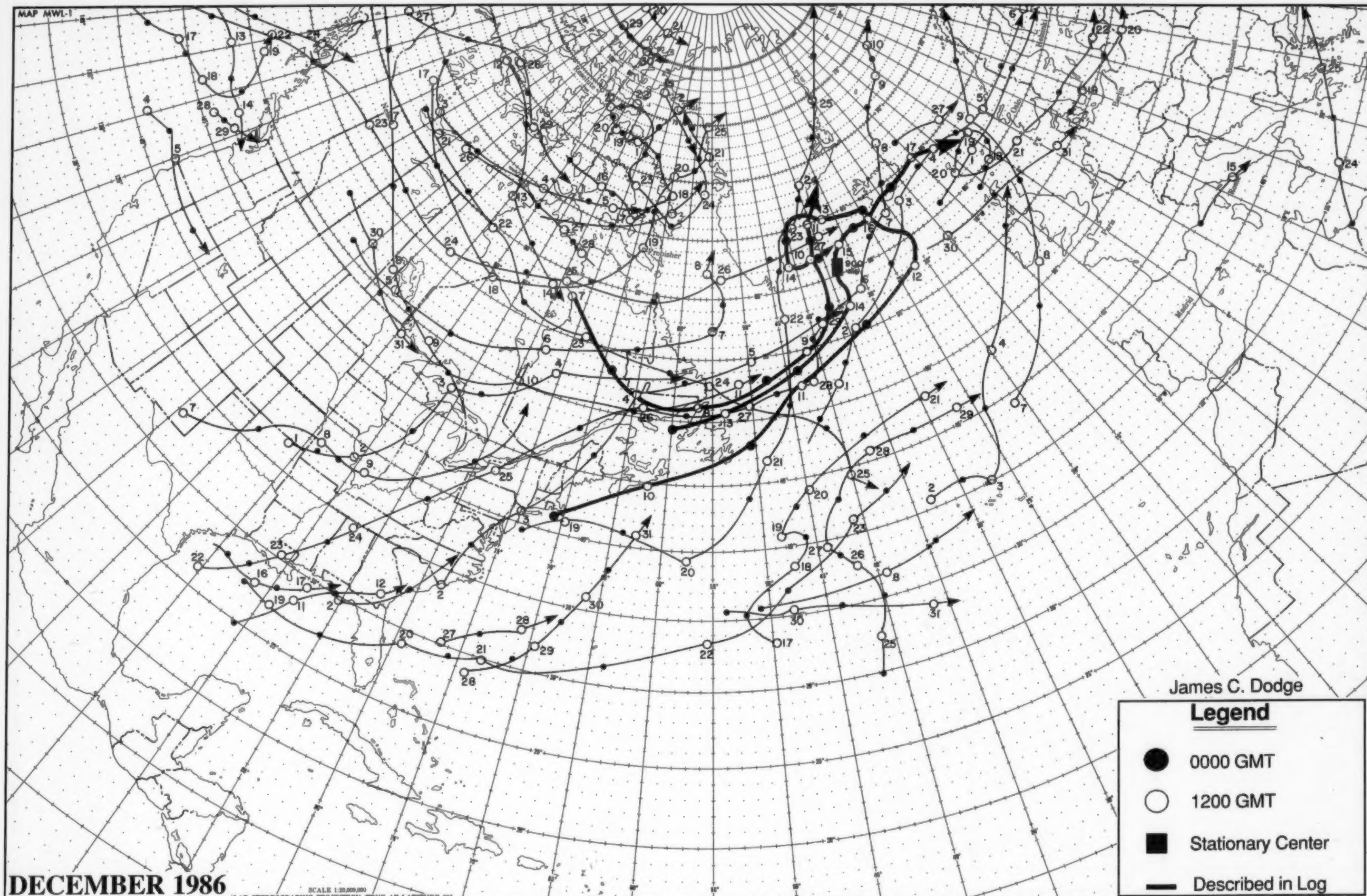
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



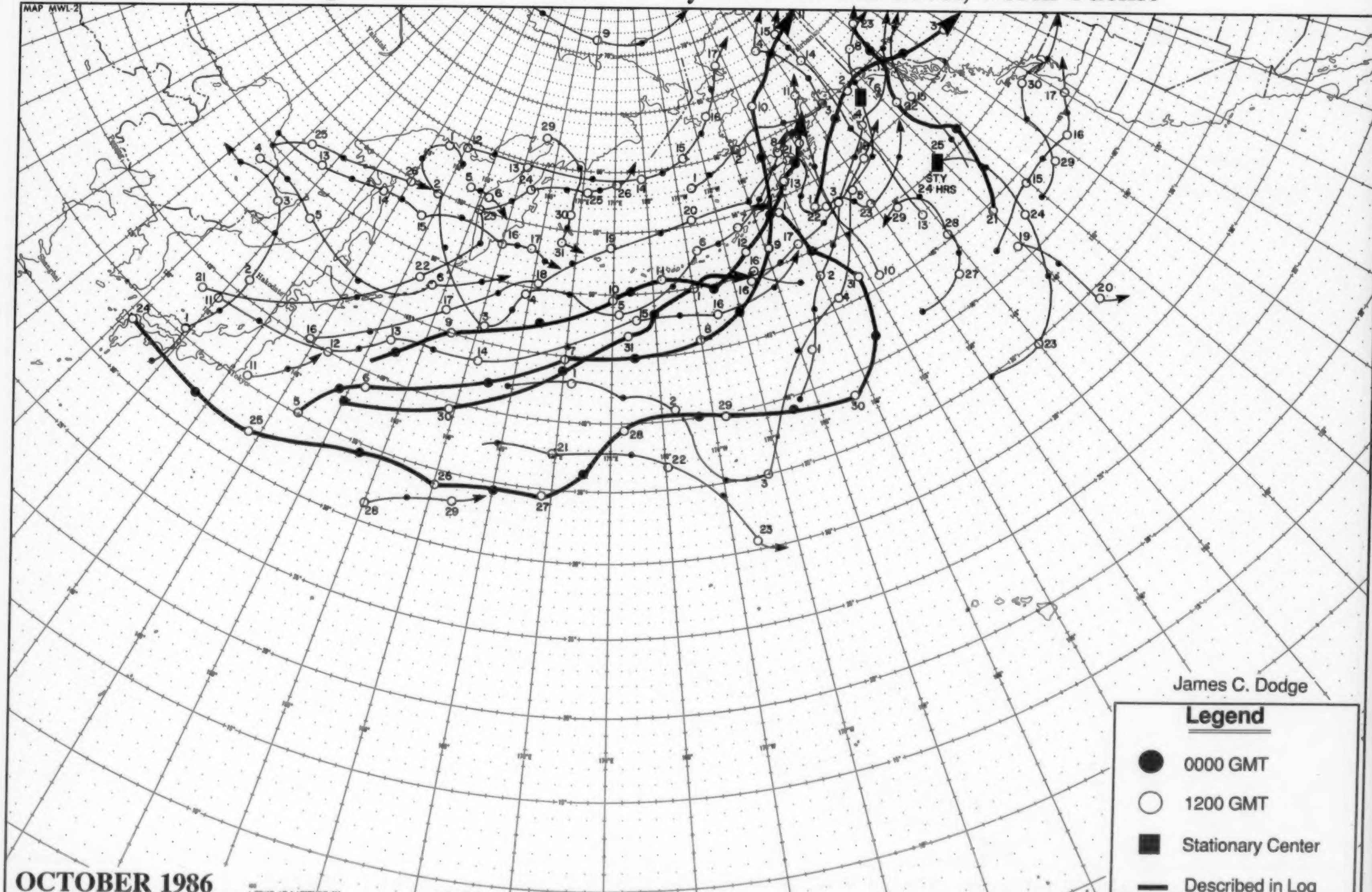
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



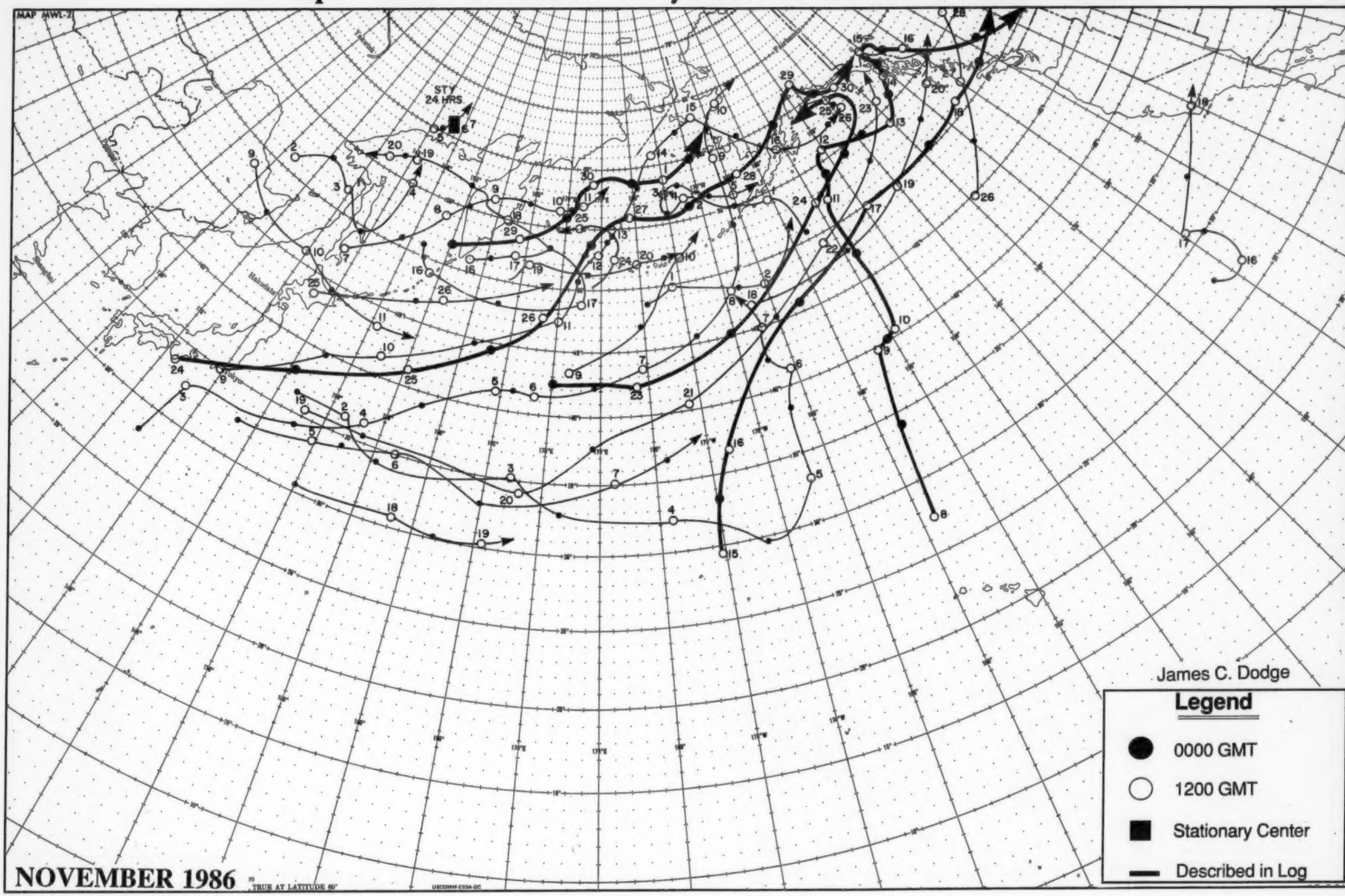
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



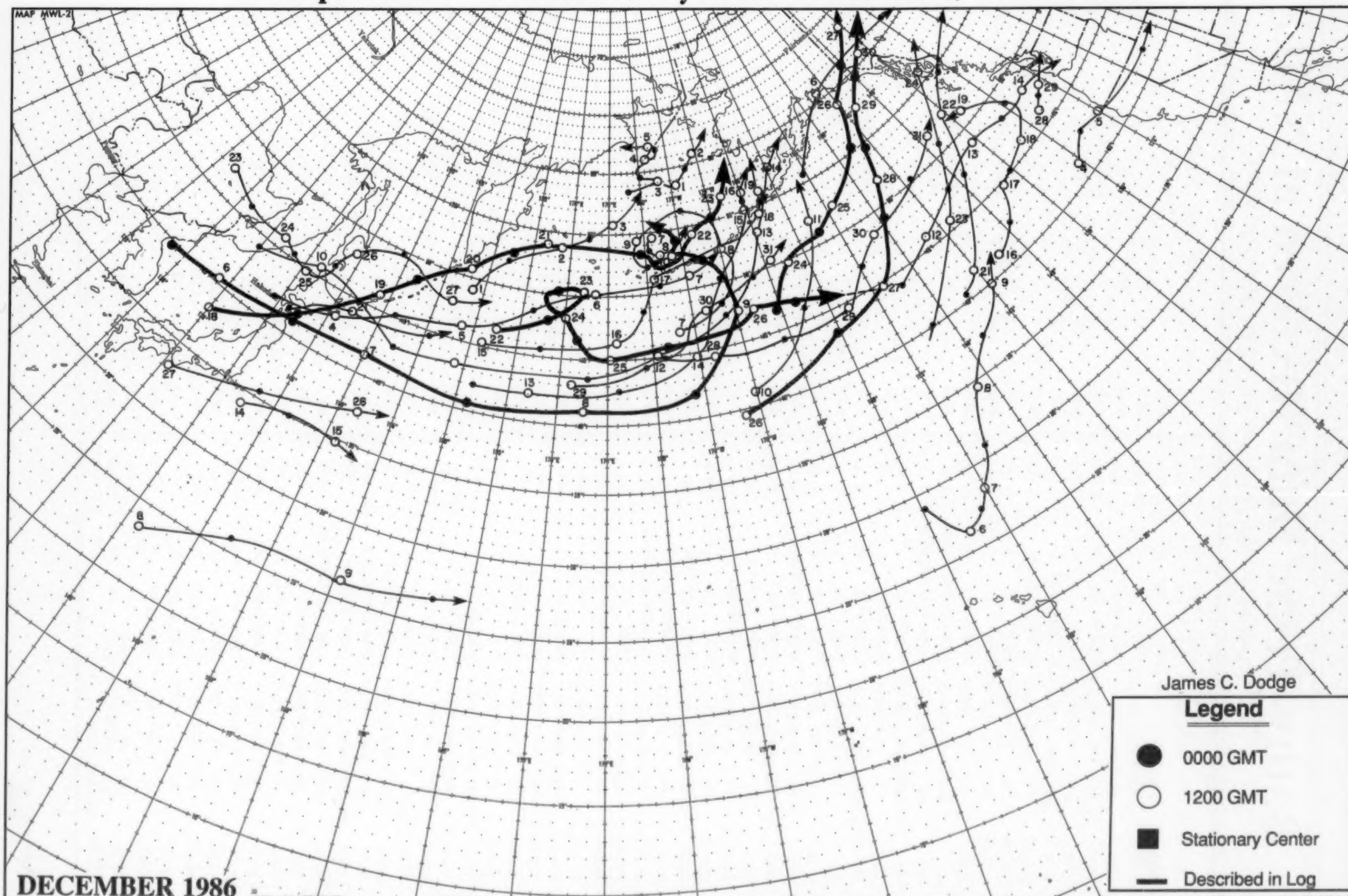
Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Bathy-Tesac Data Received at NMC

October, November and December 1986

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
BNPK	161	161	0	JIDI
BNTA	39	39	0	***
CGBS	34	34	0	PARIZEAU
CGBV	97	0	97	DAWSON
CGDG	6	6	0	HUDSON
CGDV	284	284	0	W. TEMPLEMAN
CG2683	92	92	0	ALFRED NEEDLER
CG2958	4	4	0	TULLY
CG2965	36	0	36	***
COOK	9	9	0	***
C7C	248	2	246	OCEAN STATION CHARLIE
C7L	101	101	0	OCEAN STATION LIMA
DBBH	109	109	0	METEOR
DBFJ	12	12	0	FRITHJOF
DBKV	12	12	0	SEETEUFEL
DCH	8	8	0	ELBE I
DDKB	5	5	0	***
DDMA	36	36	0	JEBSEN SOUTHLAND
DESI	73	73	0	VALDIVIA
DGFR	5	5	0	MONTE OLIVIA
DGLM	45	45	0	MONTE ROSA
DGRL	77	77	0	RIKA
DGSR	116	116	0	MONTE SARMIENTO
DGVK	84	84	0	COLUMBIA VICTORIA
DGZV	49	49	0	COLUMBUS VIRGINIA
DHCU	1	1	0	UBENA
DHCW	77	77	0	COLUMBUS WELLINGTON
DSCW	1	1	0	***
D5NZ	86	86	0	POLYNESIA
ELBX3	16	16	0	PACKING
ELDM8	23	23	0	SEAL ISLAND
ELED8	18	18	0	***
EREA	182	118	64	MONSOON
EREB	78	38	40	VOLNA
EREC	101	0	101	PRYLYV
EREH	5	0	5	PRIBOI
ERES	157	100	57	VICTOR BUGAEN
ERET	151	139	12	GEORGE OUSHAKOV
EREU	227	201	26	ERNST KRENKEL
ESGG	144	58	86	FROLOV VYACHESLAV
FNBF	19	19	0	ROSTAND
FNBG	1	1	0	CAPRICORNE
FNCW	78	78	0	ROUSSEAU
FNDU	15	15	0	ZAMBEZE
FNDZ	2	2	0	ZELANDE
FNFU	21	21	0	EL MANSOUR
FNGB	15	15	0	MARION DUFRESNE
FNGS	51	51	0	LAFAYETTE
FNOM	29	29	0	ANGO
FNPA	17	17	0	***

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
FNXE	1	1	0	RODIN
GACA	11	11	0	***
GOVN	17	17	0	ACT6
GWUK	6	6	0	STARELLA
GZKA	14	14	0	ACT 3
HCGT	26	26	0	BUCCANEER
HCJH	2	2	0	ISLA FLOREANA
HPAN	22	22	0	MICRONESIAN COMMERCE
H9BQ	52	52	0	MICRONESIAN INDEPENDENCE
JASQ	14	14	0	***
JBES	45	45	0	YAMASHIN MARU
JBMS	54	54	0	HIKAWA MARU
JBOA	39	39	0	KEIFU MARU
JCDF	1	1	0	SOYO MARU
JCDT	11	11	0	AMERICA MARU
JCIN	7	7	0	TOKYO MARU
JCLL	24	24	0	LIONS GATE BRIDGE
JCOD	31	31	0	SHOYO
JDOC	17	17	0	HIEI MARU
JDRD	15	15	0	SHOYU MARU
JFDG	105	105	0	SHUMPU MARU
JGZK	100	100	0	RYOFU MARU
JHJE	35	35	0	QUEENS WAY BRIDGE
JIOW	35	35	0	ALASKA MARU
JJLL	1	1	0	KASHU MARU
JJZC	11	11	0	HAKONE MARU
JPQX	95	95	0	CHOFU MARU
JPVB	53	53	0	SEIFU MARU
JQXW	9	9	0	HIERU MARU
KEOC	68	68	0	EDGAR M. QUEENY
KIYO	12	12	0	EXXON JAMESTOWN
KNBD	15	15	0	DELAWARE II
LZTI	33	33	0	***
NAAO	66	66	0	GLACIER
NAQD	2	2	0	JARVIS
NARK	13	13	0	***
NBTM	1	1	0	POLAR STAR
NDWA	1	1	0	MORGENTHAU
NEKF	63	63	0	LYNCH
NENC	8	8	0	ALIFT PACIFIC
NGDF	11	11	0	MUNRO
NHOC	5	5	0	CURTS
NHPA	10	10	0	STARK
NHTE	41	41	0	ELROD
NHWR	52	52	0	MIDGETT
NIKA	1	1	0	SEALIFT ATLANTIC
NJOR	143	143	0	GALLATIN
NJSP	1	1	0	SCOTT
NLVS	19	19	0	RUSH
NPCR	3	3	0	DALLAS

Bathy-Tesac Data Cont'd

October, November and December 1986

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
NRUO	82	82	0	POLAR SEA
NYGG	123	123	0	CHAUVENET
OXYL	5	5	0	BAMSA DAN
PGDG	60	60	0	NEDLLOYD KINGSTON
PGDU	48	48	0	NEDLLOYD KIMBERLEY
PGOF	45	45	0	NEDLLOYD KEMBLA
PJYG	102	102	0	OLEANDER
PLAT	120	120	0	PLATFORM
SCOV	6	6	0	TV 244
SCPE	7	7	0	TV 253
SCPH	3	3	0	TV 257
SCPK	1	1	0	TV 260
SCQG	1	1	0	TV 245
SEXN	8	8	0	TV 227
SEXQ	3	3	0	TV 278
SFYV	1	1	0	***
SGQJ	49	49	0	ELGAREN
SHIP	1516	1512	4	NO SHIP CALL SIGN REC'D
SHPF	2	2	0	TV 281
SJTR	1	1	0	TV 271
SKVP	7	7	0	***
SKVQ	1	1	0	***
SMZJ	2	2	0	TV105
SMZQ	2	2	0	TV102
TEST	25	25	0	***
TESTP	1	1	0	***
TFXQ	16	16	0	RAKKAFOSS
UAAX	108	49	59	VOYKOV
UBLF	1	0	1	KURCHATOV
UBNZ	60	60	0	SHULEYKIN AKADEMIK
UEAK	127	64	63	VALERIAN URYVAYEV
UHQC	1	1	0	***
UHQS	244	118	126	ACADEMIC KOROLEV
UJFO	143	139	4	MULTANOVSKIY PROF
UJLN	47	7	40	***
UMAY	292	134	158	ACADEMIC SHIRSHOV
UMFW	154	154	0	PROF. ZUBOV
UNAS	2	1	1	***
UNRZ	2	2	0	***
UPUI	70	48	22	PROFESSOR VIZE
URYM	30	1	29	RUDOLF SAMOILOVICH
UTRZ	61	48	13	KAVKAZ
UUPB	231	116	115	AKADEMIK N. SHOKALSKIY
UUQR	16	16	0	MOLCHANOV PAVEL PRO
UUWI	1	1	0	***
UVMJ	4	4	0	VSEVOLOD BERYOZKIN
UVMM	298	152	146	YAKOV GAKKEL
UWEC	226	123	103	KHROMOV PROFESSOR
UZCB	7	4	3	***
UZGH	116	106	10	PASSAT

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
VCBT	26	26	0	CAPE ROGER
VC9105	86	86	0	***
VC9450	27	27	0	GADUS ATLANTICA
VJNV	2	2	0	***
VKCK	34	34	0	STUART
VKCV	13	13	0	DERWENT
VKDA	11	11	0	DARWIN
VKLA	27	27	0	ADELAIDE
VKLB	18	18	0	HOBART
VKMK	49	49	0	***
VKML	12	12	0	SNIPE
VKMN	50	50	0	TEALE
VLNB	54	54	0	TORRENS
VMAP	193	193	0	AUSTRALIAN PROGRESS
VXN	29	29	0	AIRCRAFT
WCGN	81	81	0	CHEVRON CALIFORNIA
WMVC	22	22	0	J.N.COBB
WMVF	51	51	0	ALBATROSS IV
WTDF	44	44	0	T. CROMWELL
WTDK	119	119	0	D.S. JORDAN
WTDM	8	8	0	M.FREEMAN
WTDO	52	52	0	OREGON II
WTEA	21	21	0	DISCOVERER
WTEB	18	18	0	FAIRWEATHER
WTED	17	17	0	CHAPMAN
WTEF	11	11	0	RAINIER
WTEG	31	31	0	MOUNT MITCHELL
WTEJ	156	156	0	MCARTHUR
WTEK	28	28	0	DAVIDSON
WTEP	79	79	0	OCEANOGRAPHER
WTER	14	14	0	RESEARCHER
WTES	71	71	0	SURVEYOR
WTEW	24	24	0	WHITING
WXBR	43	43	0	CHEVRON MISSISSIPPI
WXQ7334	22	22	0	PETER ANDERSON
WYB8082	36	36	0	DAY STAR
WYR7512	32	32	0	BALD EAGLE
WYR9891	1	1	0	SEA HAVEN
WZE3929	21	21	0	MOANA WAVE
Y3CH	19	0	19	PROF. ALBRECHT PENCK
3FHI2	78	78	0	MOANA PACIFIC
5LFX	3	3	0	PACBARONESS
5MCB	30	30	0	PACMERCHANT
5MTA	20	20	0	PACMONARCH
7JBJ	10	10	0	RICHMOND BRIDGE
7JLY	4	4	0	***
7JOB	29	29	0	SHINKASHU MARU
7KBF	6	6	0	***
7KDD	20	20	0	YOKO MARU
7KZU	21	21	0	***
8JNZ	79	79	0	KOFU MARU

TOTAL BATHYS RECEIVED 9424 TOTAL TESACS RECEIVED 1686 TOTAL REPORTS RECEIVED 11110

U.S. Voluntary Observing Ship Weather Reports

October, November and December 1986

SHIP NAME	VIA RADIO	VIA MAIL
1ST LT ALEX BONNYMAN	6	
2ND LT. JOHN P. BOBO	51	31
ACADIA FOREST	36	28
ACE ACCORD	80	75
ACT 10	40	72
ACT III	41	
ACT 5	45	
ACT 6	134	
ACT 7	105	
ACT 9	55	
ACT I	71	
ACT IV	15	
ADABELLE LYKES	70	165
ADDIRIYAH	23	24
ADMIRALTY BAY	22	138
ADONIS	16	
AFRIC STAR	24	
AFRICAN ADDAX	10	
AL AHMADIAH	32	
ALAMEDA	13	34
ALASKA MARU	89	
ALASKA RAINBOW	52	130
ALBULA	7	
ALDEN W.CLAUSEN	11	37
ALEMANIA EXPRESS	58	
ALLEMAGNA EXPRESS	23	47
ALLIGATOR FORTUNE	66	
ALLIGATOR GLORY	35	130
ALLIGATOR HOPE	71	131
ALMUDENA	11	48
ALTAIR	21	
ALTAMONTE	23	30
ALTIMIRA	6	
ALVA MAERSK	12	17
AM.TRADER	1	
AMBASSADOR BRIDGE	177	43
AMELIA TOPIC	48	203
AMERICA EXPRESS	51	
AMERICA SUN	31	173
AMERICAN ALABAMA	50	84
AMERICAN APOLLO	3	39
AMERICAN AQUARIUS	55	94
AMERICAN ARGO	10	20
AMERICAN ASTRONAUT	23	126
AMERICAN CALIFORNIA	14	31
AMERICAN CONDOR	29	61
AMERICAN CORMORANT	17	12
AMERICAN EAGLE	56	137
AMERICAN ENTENTE	84	210
AMERICAN ENVOY	26	147
AMERICAN FALCON	25	68
AMERICAN GEORGIA	12	
AMERICAN HARRISON	38	
AMERICAN HAWAII	13	53
AMERICAN ILLINOIS	11	

SHIP NAME	VIA RADIO	VIA MAIL
AMERICAN KENTUCKY	16	84
AMERICAN LANCER	52	116
AMERICAN LYNX	50	136
AMERICAN MAINE	58	170
AMERICAN MARINER		55
AMERICAN MARKETER	33	142
AMERICAN MERCHANT	75	210
AMERICAN MICHIGAN	25	27
AMERICAN NEBRASKA	28	137
AMERICAN NEW JERSEY	3	76
AMERICAN NEW YORK	30	54
AMERICAN NORTH CAROLIN	25	54
AMERICAN OHIO	21	
AMERICAN OKLAHOMA	8	
AMERICAN PIONEER	57	219
AMERICAN PURITAN	43	133
AMERICAN REPUBLIC		48
AMERICAN RESOLUTE	43	79
AMERICAN TITAN AK 1008	1	
AMERICAN TROJAN	19	40
AMERICAN UTAH	2	
AMERICAN VETERAN	46	
AMERICAN VIRGINIA	6	51
AMERICAN WASHINGTON	9	125
AMERICANA	31	23
AMOCO BALTIMORE	3	
AMOCO YORKTOWN	15	14
ANDERS MAERSK	60	58
ANDERSON		109
ANITA	20	11
AQUA CITY	141	72
AQUA GARDEN	61	163
AQUARIUS	46	136
ARCHON	56	
ARCO ALASKA	25	42
ARCO ANCHORAGE	37	57
ARCO CALIFORNIA	28	16
ARCO INDEPENDENCE	1	
ARCO PRUDHOE BAY	40	53
ARCO SAG RIVER	21	33
ARCO SPIRIT	24	28
ARCO TEXAS	12	21
ARCTIC TOKYO	2	91
ARGONAUT	34	28
ARIES	1	
ARILD MAERSK	10	38
ARMAND HAMMER	4	43
ARMCO	1	
ASHLEY LYKES	15	39
ASIA INDUSTRY	1	
ASIA WINDS	93	
ASIAN EXPRESS	16	
ASIAN HIGHWAY	48	
ASIAN VENTURE	29	17
ASPEN	35	139

SHIP NAME	VIA RADIO	VIA MAIL
ASTORIA	31	76
ASYA	43	16
ATIGUN PASS	80	211
ATLANTIC	1	
ATLANTIC COMPANION	59	
ATLANTIC RAINBOW	7	
ATLANTIC SAGA	68	
ATLANTIC SERVICE	65	
ATLANTIC SONG	44	
ATLANTIC SPIRIT	61	155
ATLANTIC STAR	95	
AUSTANGER	3	
AUSTRAL RAINBOW	9	44
AXEL MAERSK	1	
B.T. ALASKA	13	51
B.T. SAN DIEGO	82	253
BACOL SANTOS	44	
BALLARD	9	50
BALTIMORE TRADER	66	120
BAR' ZAN	7	32
BARBER PERSEUS	53	
BARBER PRIAM	1	
BARBER TEXAS	39	
BARBER TOBA	11	
BARRYDALE	82	36
BAY BRIDGE	83	98
BCR KING	132	
BCR QUEEN	23	
BEISHU MARU	27	14
BENNINGTON	7	40
BERNINA	30	99
BHARATENDU	13	
BHAVABHUTI	35	16
BIBI	35	
BISLIG BAY	36	103
BLUE COSMO	15	
BOGASARI DUA	31	59
BOGASARI LIMA	1	
BORINQUEN	14	191
BRINTON LYKES	33	63
BROOKLYN	42	87
BROOKS RANGE	45	39
BUFFALO		7
BUNGA KESIDANG	32	116
BUNGA MELAWIS	28	85
BURNS HARBOR		128
CALANUS		15
CALIFORNIA RAINBOW	65	114
CALIFORNIA VENUS	27	
CANAL ACE		28
CARIBE 1	37	40
CARLA A. HILLS	19	195
CARMEN	48	
CAVALIER		26
CAVARA	15	

SHIP NAME	VIA RADIO	VIA MAIL
CENPAC 2	60	109
CGM LORRAINE	60	
CHABLIS	1	
CHARLES M. BEEGHLEY	37	
CHARLOTTE LYKES	85	102
CHARLOTTE MAERSK	30	105
CHASTINE MAERSK	24	98
CHELSEA	37	93
CHEMICAL PIONEER	19	56
CHERRY VALLEY	10	24
CHESAPEAKE	8	14
CHESAPEAKE TRADER	23	152
CHESNUT HILL	3	129
CHEVRON ANTWERP	45	5
CHEVRON ARIZONA	14	31
CHEVRON BURNABY	58	108
CHEVRON CALIFORNIA	68	33
CHEVRON COLORADO	22	40
CHEVRON COPENHAGEN	36	231
CHEVRON EDINBURGH	5	63
CHEVRON EQUATOR	7	77
CHEVRON FELUY	27	145
CHEVRON FRANKFURT	71	
CHEVRON LONDON		151
CHEVRON LOUISIANA	41	67
CHEVRON METEOR		88
CHEVRON MISSISSIPPI	115	196
CHEVRON NAGASAKI		105
CHEVRON OREGON	33	144
CHEVRON PACIFIC	24	74
CHEVRON WASHINGTON	7	88
CHIKUMAGAWA MARU	2	
CHRISTIAN MAERSK	6	37
CHRISTINA	30	
CHUEN ON	10	
CINTA		4
CITADEL HILL	55	
CITY OF MIDLAND	11	76
CLARA MAERSK	38	134
CLIFFORD MAERSK	41	122
CLOVER TRUST	59	101
CO-OP EXPRESS I	53	
CO-OP EXPRESS II	105	24
CO-OP EXPRESS V	19	
COLIMA	39	80
COLORADO HIGHWAY	92	
COLUMBIA STAR		109
COLUMBUS AMERICA	89	
COLUMBUS AUSTRALIA	57	
COLUMBUS CALIFORNIA	112	
COLUMBUS LOUISANA	68	
COLUMBUS VICTORIA	115	
COLUMBUS VIRGINIA	121	
COLUMBUS WELLINGTON	109	
CONTINENTAL HIGHWAY	87	

SHIP NAME	VIA RADIO	VIA MAIL
CONTINENTAL TRADER	5	
COOP GRAIN #2	3	
COPIAPO	21	29
CORNELIA MAERSK	37	141
CORNUCOPIA	66	204
CORONADO	10	56
COUNTESS-SKY	21	23
CPL. LOUIS J. HAUGE JR	40	16
CRYSTAL STAR	14	122
CURRENT	51	103
D.L. BOWER		151
DACEBANK	117	
DAIEI MARU	50	
DALAMAN	4	
DAMIAO DE GOIS	23	
DANDY #1	2	
DART AMERICA	45	
DAVID PACKARD	7	
DAWN	27	100
DEL SUR	9	
DELAWARE TRADER	52	67
DIANA	2	34
DILKARA	19	
DOCK EXPRESS TEXAS	83	250
DOMINA	41	
DRAGOR MAERSK	4	68
DUBHE	30	122
DUSSELDORF EXPRESS	37	
DYUI SKAGERAK	23	76
DYVI KATTEGAT	18	251
E.R. BRUSSEL	24	
EASTERN FRIENDSHIP	30	128
EASTERN GLORY	34	168
EASTERN MOON	1	
EASTERN ROYAL	38	
EASTERN VENTURE	11	
EDGAR M. QUEENY	13	
ELBE EXPRESS	24	
ELBE MARU	115	
ELGAREN	55	
ENDEAVOR	22	20
ERLANGEN EXPRESS	7	
ERNEST R. BREECH	69	53
ESTHER SCHULTE	10	
EVER GARDEN	1	
EVER GATHER	1	
EVER GENIUS	3	6
EVER GENTRY	1	
EVER GIANT	13	95
EVER GIFTED	15	12
EVER GIVEN	12	15
EVER GLEAMY	3	
EVER GLOBE	4	30
EVER GLORY	14	
EVER GOING	1	

SHIP NAME	VIA RADIO	VIA MAIL
EVER GOLDEN	2	4
EVER GOODS		46
EVER GOVERN	1	
EVER GRACE	41	105
EVER GRADE	7	34
EVER GRAND	18	15
EVER GROUP	42	58
EVER GROWTH	9	26
EVER GUARD		5
EVER GUEST	17	92
EVER GUIDE	6	
EVER LAUREL	4	3
EVER LEVEL	39	89
EVER LIVING	31	18
EVER LYRIC	1	2
EVER SHINE	23	23
EVER SPRING	5	
EVER SUMMIT	37	108
EVER SUPERB	3	5
EVER TRUST	34	
EVER VALOR	40	190
EVER VALUE	4	
EVER VIGOR	19	36
EVER VITAL	25	61
EX FREEDOM		24
EXPORT CHALLENGER	20	15
EXPORT CHAMPION	9	65
EXPORT FREEDOM	33	111
EXPORT PATRIOT	24	29
EXXON BALTIMORE	4	28
EXXON BATON ROUGE	1	
EXXON BAYTOWN	4	21
EXXON BENICIA	24	49
EXXON BOSTON	26	68
EXXON CHARLESTON	3	
EXXON HOUSTON	22	22
EXXON JAMESTOWN	16	64
EXXON LEXINGTON	14	31
EXXON NEW ORLEANS	72	98
EXXON NORTH SLOPE	19	28
EXXON PHILADELPHIA	12	19
EXXON PRINCETON	1	49
EXXON SAN FRANCISCO	7	10
EXXON VALDEZ	1	8
EXXON WASHINGTON	35	60
EXXON YORKTOWN		20
FALCON LEADER	57	84
FALSTAFF	11	43
FALSTRIA	68	63
FEDERAL FRASER	54	119
FEDERAL LAKES	21	95
FEDERAL SEAWAY	21	53
FERNCROFT	127	213
FESTIVALE	3	14
FETISH	49	

SHIP NAME	VIA RADIO	VIA MAIL
FLORIDA RAINBOW	41	113
FORTALEZA	99	215
FRANCIS SINCERE NO. 6	46	30
FRED R WHITE JR		83
FRONTIER ACE	2	
FROTASIRIUS	9	
GALLEON AQUAMARINE	21	47
GALVESTON	51	63
GAMA SETAH	1	
GAZANIA	78	203
GEMINI	79	80
GENERAL M.BELGRANDO	25	26
GENEVIEVE LYKES	31	86
GENISTA	1	
GEORGE A. STINSON		117
GEORGE H. WEYERHAEUSER	2	6
GEORGE WASHINGTON BRID	31	15
GERONIMO		2
GLACIER BAY	44	133
GLOBAL FRONTIER	96	187
GLOBAL PIONEER	12	
GLOBAL SPLENDOR	54	131
GLORIOUS SPICA	33	16
GLORY SPIRIT	31	27
GOLDEN APO	12	
GOLDEN BLISS	76	49
GOLDEN GATE BRIDGE	91	114
GOLDEN GRAMPUS	17	
GOLDEN HAWK	29	78
GOLDEN HILL	33	69
GOWA	6	
GREAT LAND	35	31
GREAT OCEAN	76	51
GREEN FOREST	22	10
GREEN HARBOUR	65	
GREEN ISLAND	22	54
GREEN KOBE	26	41
GREEN MASTER	70	144
GREEN MAYA	29	12
GREEN SASEBO	74	91
GREEN STAR	6	
GREEN VALLEY	79	113
GREEN WAVE	61	78
GUAICURI	71	188
GULF IDEAL	30	49
GYPSUM COUNTESS	289	
GYPSUM KING	324	
H. LEE WHITE		48
H.J. HAYNES		189
HAKUSAN	12	59
HAKUSAN MARU	99	
HANJIN BUSAN		2
HANJIN HONG KONG	5	13
HANJIN INCHEON	1	
HANJIN KOBE		13

SHIP NAME	VIA RADIO	VIA MAIL
HANJIN KWANGYANG	16	19
HANJIN LONG BEACH	11	14
HANJIN NEW YORK		13
HANJIN POHANG	27	
HANJIN SEOUL	1	8
HASSAN MERCHANT	126	99
HEERENGRASHT	47	
HENRY FORD II		27
HERBERT C. JACKSON	43	65
HERMENIA	45	37
HIEI MARU	55	
HIKAWA MARU	156	
HIRA MARU	117	
HIYOSHI MARU	61	
HOEGH CAIRN	4	28
HOEGH CLIPPER	9	32
HOEGH DRAKE		62
HOEGH DUKE	80	
HOEGH MARLIN	5	28
HOEGH MASCOT	7	129
HOEGH MINERVA	4	10
HOEGH MIRANDA	39	110
HOHSING ARROW	15	
HOHSING BREEZE	24	46
HOLIDAY	6	22
HOMERIC	7	
HONOLULU	41	
HRELJIN	39	
HUAL TRACER	4	
HYUGA MARU	33	
HYUNDAI #1	39	17
HYUNDAI CHALLENGER		80
HYUNDAI CON SIX	2	
HYUNDAI EXPLORER	15	53
HYUNDAI INNOVATOR		101
HYUNDAI ISLAND		14
HYUNDAI PIONEER	7	18
INCOTRANS PACIFIC	34	
INDONESIA VICTORY	15	
INGER	42	185
IRVING ARCTIC	136	
IRVING MIAMI	27	
ISLAND HOPE		61
ISLAND PRINCESS	147	
ISOLDE	13	29
ITALICA	16	17
J.A.W. IGLEHART	17	80
J.L. MAUTHE	47	107
J.T. HIGGINS		214
JADRAN	5	143
JALAGOVIND	14	
JALAMOKAMBI	7	
JALAVIHAR	5	
JALAVIJAYA	17	
JALISCO	17	31

SHIP NAME	VIA RADIO	VIA MAIL
JAMES LYKES	22	81
JAMES R. BARKER		49
JAPAN ALLIANCE	58	36
JAPAN APOLLO	76	48
JAY LAXMI	1	
JEAN LYKES	15	120
JOHN A. MCCONE		170
JOHN LYKES	59	87
JOSEPH L. BLOCK		20
JOSEPH LYKES	31	58
JOVIAN LILY	46	151
JOVIAN LUZON	16	49
JUBILEE	30	123
JULIUS HAMMER		36
KALIDAS	32	69
KAMNIK	2	
KASINA	57	30
KASTURBA	23	
KAUAI	62	191
KEE LUNG	52	53
KEN TRADER	81	121
KENAI	13	49
KENNETH E. HILL	13	61
KENNETH T. DERR	31	75
KENT	72	157
KEYSTONE CANYON	32	174
KEYSTONER	43	202
KISO MARU	124	
KITTANNING	20	16
KOFUKU MARU	29	109
KOLN EXPRESS	71	
KOREAN JACEWON	30	
KOREAN WONIS JIN	26	32
KOREAN WONIS ONE	29	32
KOREAN WONIS SEVEN	15	27
KOREAN WONIS SUN	24	28
KRPAN	1	
KUROBE MARU	96	
LA PAMPA	4	
LANAI	11	
LARS MAERSK	88	179
LAURA MAERSK	16	34
LAUST MAERSK	32	96
LAWRENCE A. GIANELLA	65	189
LEDA MAERSK	24	61
LEISE MAERSK	34	30
LEO TEMPEST	16	
LERMA	140	
LESLIE LYKES	6	
LETITIA LYKES	12	57
LEWIS WILSON FOY		179
LEXA MAERSK	45	98
LIBERTADOR GRAL SAN MA	10	10
LICA MAERSK	25	22
LILLOOET	63	108

SHIP NAME	VIA RADIO	VIA MAIL
LIONS GATE BRIDGE	107	151
LLOYD SAO PAULO	1	
LNG TAURUS	24	137
LOTUS ACE	112	
LOUIS J.HANGE		8
LOUIS MAERSK	43	54
LOUISE LYKES	73	100
LOUISIANA MAMA	55	111
LPG HARDANGER		207
LT. ODYSSEY	21	
LUCENT STAR	59	39
LURLINE	87	158
LUZON	41	49
LUZON VICTORY	21	
LYRA	21	52
M. P. GRACE	2	
MADANG	7	
MAERSK WAVE	65	21
MAJ SANDVED	92	153
MAJ. STEPHEN W. PLESS	45	46
MALAKAND	6	27
MALLORY LYKES	1	
MANSAL DESAI	38	
MANILA PACIFIC	1	
MANUKAI	92	173
MANULANI	52	196
MARABANK	19	13
MARATHA MARINER	27	15
MARATHA MELODY	25	
MARATHA SHOGUN	15	
MARCHIONESS	4	
MARGARET LYKES	89	196
MARIA TOPIC	39	40
MARIF	3	53
MARITIME NOBLE	122	
MARJORIE LYKES	33	57
MATARAM	2	
MAUI	62	164
MC KINNEY MAERSK	37	122
MEDALLION	76	69
MEDUSA CHALLENGER	90	185
MELBOURNE HIGHWAY	4	20
MELVILLE	44	59
MENINA BARBARA	26	
MERAK EIGHTY	18	30
MERIDA	13	
MESABI MINER		67
MICROBA	39	
MICRONESIAN COMMERCE	11	46
MICRONESIAN INDEPENDEN	146	168
MIDDLETOWN	11	4
MILTA	31	
MING MOON	2	35
MING OCEAN	27	37
MING PROPITIOUS	4	
MING SPRING	27	
MING STAR	3	7
MING SUN	18	
MING WINTER	1	
MOANA PACIFIC	79	131
MOBIL ARCTIC	55	185
MOBIL MERIDIAN	36	136
MOKU PAHU	109	110
MONISBON	7	
MORMACSKY	20	91
MORMACSTAR	14	59
MORMACSUN	6	51
MOSEL EXPRESS	98	
MOUNT VERNON VICTORY	37	86
MV TRUDY	60	81
MYRON C. TAYLOR	1	
NACIONAL SANTOS	3	
NANCY LYKES	18	60
NATIONAL DIGNITY	38	210
NATIONAL HONOR	12	163
NATIONAL INTEGRITY	2	53
NATIONAL PRIDE	19	25
NAVIGATOR		238
NEASHO		15
NEDLLOYD ELBE	47	
NEDLLOYD KATAJK	91	
NEDLLOYD KEMBLA	86	
NEDLLOYD KIMBERLEY	67	
NEDLLOYD KINGSTON	78	
NEDLLOYD KYOTO	118	
NEDLLOYD ROCHESTER	113	
NEDLLOYD ROSARIO	69	
NEDLLOYD ROTTERDAM	138	
NEDLLOYD ROUEN	91	
NEPTUNE ACE	246	
NEPTUNE AMBER	89	211
NEPTUNE CORAL	88	113
NEPTUNE DIAMOND	205	169
NEPTUNE GARNET	98	
NEPTUNE IVORY	64	
NEPTUNE PEARL	46	165
NEPTUNE TOURMALINE	58	
NEPUNE CYPRINE	32	
NEW HORIZON		103
NEW INDEPENDENCE	76	94
NEW JERSEY MARU	103	
NEW YORK MARU	100	
NISSAN MARU	78	
NOAA DAVID STARR JORDA	99	110
NOAA SHIP ALBATROSS IV	203	277
NOAA SHIP CHAPMAN	143	170
NOAA SHIP DAVIDSON	126	192
NOAA SHIP DELAWARE II	224	345
NOAA SHIP DISCOVERER O	167	108
NOAA SHIP FAIRWEATHER	133	184
NOAA SHIP FERREL	181	94
NOAA SHIP JOHN N COBB	36	68
NOAA SHIP MCARTHUR	319	484
NOAA SHIP MILLER FREEM	87	266
NOAA SHIP MT MITCHEL	298	
NOAA SHIP OCEANOGRAPHE	163	196
NOAA SHIP OREGON II	228	282
NOAA SHIP RAINIER	81	145
NOAA SHIP RESEARCHER	45	207
NOAA SHIP SURVEYOR	51	116
NOAA SHIP T. CROMWELL	96	130
NOAA SHIP WHITING	281	336
NOORDAM	45	
NORDHVAL	131	118
NORDWOGE	2	
NORWAY	18	47
NOSAC EXPRESS	27	26
NOSAC SEL	33	83
NOSAC TAKARA	22	
NOSAC TAKAYAMA	205	156
NOSAC TRIGGER	27	
NOSAC VERDE	10	66
NOVA COSMOS	1	
NUESTRA SENORA D ROSAR	4	23
NURNBERG EXPRESS	51	
OAK GLORY	25	64
OAK PEARL	47	
OAK SUN	64	
OAKLAND	191	233
OBERON	9	31
OCEAN CHEER	57	3
OCEAN COMMANDER #1	8	17
OCEAN DIANA	20	
OCEAN STEELHEAD	53	
OCTA	41	53
OGDEN WABASH	1	
OLEANDER	132	152
OLIVE ACE	13	
ORANGE ACE	32	23
ORANGE BLOSSOM	15	
OREGON RAINBOW	30	150
OREMAR	1	
ORIENTAL ANGEL	1	
ORIENTAL DIPLOMAT	55	48
ORIENTAL EDUCATOR	113	239
ORIENTAL EXECUTIVE	43	169
ORIENTAL EXPLORER	39	227
ORIENTAL KNIGHT	25	23
ORIENTAL MINISTER	28	
ORIENTAL PHOENIX	1	196
ORIENTAL PRINCE	115	
ORIENTAL TAIO	33	
ORION HIWAY	70	120
OVERSEAS ALICE	35	48
OVERSEAS ARCTIC	14	24

SHIP NAME	VIA RADIO	VIA MAIL
OVERSEAS CHICAGO	20	56
OVERSEAS JUNEAU	30	71
OVERSEAS MARILYN	49	138
OVERSEAS NATALIE		12
OVERSEAS OHIO	16	98
OVERSEAS VALDEZ	32	13
OVERSEAS VIVIAN	27	87
OVERSEAS WASHINGTON	7	116
PACBARON	32	
PACBARONESS	1	
PACDUCHESS	12	
PACDUKE	10	
PACEMPEROR	32	19
PACGLORY	32	13
PACIFIC ANGEL	49	68
PACIFIC ARROW	99	
PACIFIC CLIPPER	17	
PACIFIC DOWN	15	78
PACIFIC HIGHWAY	77	
PACIFIC LIGHT	6	
PACIFIC PRINCESS	49	
PACIFIC PROGRESS		12
PACIFIC RAINBOW	82	115
PACIFIC VENTURE	174	
PACIFIC VICTORY	51	140
PACIFIC WING	54	
PACKING	37	
PACMAJESTY	23	
PACMERCHANT	72	30
PACMONARCH	44	
PACNOBLE	14	
PACPRINCESS	23	42
PALM ACE	18	
PANAMA	28	
PANCALDO	27	75
PATRIOT	9	22
PAUL BUCK	19	22
PAUL H. TOWNSEND	22	96
PAUL PIGOTT	4	
PAUL THAYER		23
PEGGY DOW	105	
PENNSYLANIA RAINBOW	1	78
PERUVIAN REEFER		3
PETERSBURG	23	
PETERSFIELD	25	
PFC DEWAYNE T. WILLIAM	1	
PFC EUGENE A. OBREGON	2	
PFC WILLIAM B. BAUGH	24	46
PFC. JAMES ANDERSON JR	20	43
PHILADELPHIA	112	277
PHILIPPINE VICTORY	16	76
PILAR	24	58
PLANTIN	20	
POLAR ALASKA	14	187
POLYNESIA	196	239

SHIP NAME	VIA RADIO	VIA MAIL
PONCE	28	28
POQUITA MAMI	32	71
POTOMAC TRADER	26	76
PRECIOUS ISLAND	1	
PRESIDENT ADAMS	42	153
PRESIDENT CLEVELAND	7	48
PRESIDENT EISENHOWER	116	209
PRESIDENT F. ROOSEVELT	89	197
PRESIDENT FILLMORE	25	65
PRESIDENT GRANT	40	184
PRESIDENT HOOVER	71	168
PRESIDENT JACKSON	40	50
PRESIDENT JEFFERSON	94	261
PRESIDENT JOHNSON	81	307
PRESIDENT KENNEDY	15	19
PRESIDENT LINCOLN	49	194
PRESIDENT MADISON	112	274
PRESIDENT MC KINLEY	26	199
PRESIDENT MONROE	88	242
PRESIDENT PIERCE	52	204
PRESIDENT TAFT	34	64
PRESIDENT TAYLOR	32	130
PRESIDENT TRUMAN	16	34
PRESIDENT TYLER	66	68
PRESIDENT VAN BUREN	34	
PRESIDENT WASHINGTON	164	159
PRESIDENT WILSON	18	
PRESQUE ISLE		134
PRINCE OF TOKYO	95	216
PROSPERIDAD	71	92
PUNTA ANCLA	7	
PUNTA BRAVA	7	1
PVT HARRY FISHER	12	41
QUATSINO SOUND	58	260
QUEEN ELIZABETH 2	16	
QUEEN OPAL	64	27
QUEENS WAY BRIDGE	114	
RADWAN-PANAMA	55	130
RAINBOW BRIDGE	69	65
RAINBOW HOPE		228
REGINA MAERSK	40	115
RHEIN EXPRESS	108	
RICH VICTORIA	20	
RICHARD G MATTIESEN	8	
RIMBA SEPETIR	13	
RIO ESQUEL	54	18
RIO FRIO	6	
RIO GRANDE	9	
RIO LIMAY	26	
RIO TEUCO	8	
ROACHBANK	3	
ROBERT CONRAD		162
ROBERT E. LEE	19	29
RODIN	6	
ROSARIO DEL MAR	32	121

SHIP NAME	VIA RADIO	VIA MAIL
ROSINA TOPIC	6	183
ROSTAND	42	
ROTTERDAM	23	
ROUSSEAU	144	
ROYAL PRINCESS	40	
ROYAL VIKING SEA	33	
RUTH LYKES	33	
S.S. ROVER	20	157
S.S.CHILBAR	7	
S.T. CRAPO	22	128
SAM HOUSTON	23	28
SAMOAN REEFER	94	207
SAMRAT ASHOK	9	
SAN JUAN	60	188
SAN MATEO VICTORY	1	
SAN PEDRO	69	212
SANKO AMETHYST	1	
SANKO AZALEA	2	
SANKO CYRSTAL	8	
SANKO DAFFODIL	1	
SANKO ETERNITY	2	
SANKO HAWK	28	15
SANKO HEART	13	
SANKO HELIANTHUS	22	
SANKO HIBISCUS	4	
SANKO LAPIS	17	
SANKO LILY	78	93
SANKO NOBLE	37	105
SANKO PEACE	38	
SANKO PEACOCK	19	
SANKO PEARL	43	
SANKO STAR	13	7
SANKO STORK	18	
SANKO SWIFT	21	60
SANKO TURQUOISE	17	36
SANSINENA II	5	8
SANTA ADELA	87	119
SANTA CRUZ	17	40
SANTA CRUZ II	25	
SANTA JUANA	87	193
SATURN DIAMOND	44	
SAUDI DIRIYAH	30	
SAVANNAH	146	
SAVONITA	49	223
SCANDINAVIAN HIGHWAY	132	
SEA BELLS	33	47
SEA DIAMOND	53	72
SEA FAN	68	115
SEA FORTUNE	28	164
SEA GLORY	3	
SEA HAVEN		18
SEA JADE	58	21
SEA LANTERN	22	180
SEA LIGHT	51	150
SEA QUEEN	7	

SHIP NAME	VIA RADIO	VIA MAIL
SEALAND ADVENTURER	122	128
SEALAND BOSTON	39	40
SEALAND CONSUMER	68	207
SEALAND DEFENDER	66	180
SEALAND DEVELOPER	76	213
SEALAND ECONOMY	56	176
SEALAND ENDURANCE	46	140
SEALAND EXPLORER	61	114
SEALAND EXPRESS	47	169
SEALAND FREEDOM	72	84
SEALAND INDEPENDENCE	66	144
SEALAND INNOVATOR	67	147
SEALAND LEADER	40	162
SEALAND LIBERATOR	54	118
SEALAND MARINER	61	179
SEALAND PACER	26	179
SEALAND PATRIOT	67	182
SEALAND PIONEER	31	97
SEALAND PRODUCER	47	116
SEALAND VENTURE	76	132
SEALAND VOYAGER	33	209
SEDCO/BP 471	29	
SEVEN OCEAN	8	2
SGT WILLIAM R BUTTON	49	216
SGT. METEJ KOCAK	25	44
SHELDON LYKES	77	118
SHELLY BAY	25	2
SHENAHON	2	4
SHIN BEISHU MARU	22	
SHINKASHU MARU	84	
SHIRLEY LYKES	4	50
SILVER CLIPPER	19	
SINGAPORE VICTORY	20	97
SIOUX TATE	18	
SKAUGRAN	29	115
SKOUBORD	63	135
SKRIM	14	16
SOARER CUPID	63	137
SOARER DIANA	86	241
SOLON TURMAN	15	
SOPHIA	111	
SOUTHERN VIRGO	45	96
SOUTHLAND STAR	158	
SOUTHWARD	99	128
SPIRIT OF LIBERTY	6	
SPRING BEAR	65	
SPRING BIRD	31	41
SPRING BREEZE		120
ST EMILION		84
ST. CLAIR		117
STAR DIEPPE	39	
STAR DOVER	19	
STAR EAGLE	33	
STAR GRAN	8	123
STAR HONGKONG	9	20

SHIP NAME	VIA RADIO	VIA MAIL
STAR KANDA	26	21
STAR OF TEXAS	25	10
STAR THAILAND	12	86
STARWARD	62	155
STELLA LYKES	20	
STEWART J. CORT		189
STOLT LANDAFF	1	
STONEWALL JACKSON	8	
STRATHCONON	111	
STREAM BUSUANGA	3	
STUTTGART EXPRESS	37	
SUN PRINCESS	31	
SUN VIKING	5	
SUNBELT DIXIE	164	229
SYOSSET	19	61
TABASCO	14	34
TAI CORN	32	
TAI SHING	10	
TARGET	90	40
TENCHBANK	47	
TEPOZTLAN	50	64
TESTER	84	84
TEXACO GEORGIA	12	41
TEXACO MINNESOTA	14	
TEXAS SUN	1	16
TFL ENTERPRISE	36	78
TFL EXPRESS	8	28
TFL FREEDOM	22	174
TFL INDEPENDENCE	50	179
TFL ITALY	54	
TFL JEFFERSON	21	102
TFL LIBERTY	61	143
THOMAS G. THOMPSON	69	83
THOMPSON LYKES	62	43
THOMPSON PASS	6	78
TOHBEI MARU	45	29
TOKYO MARU	38	
TOKYO RAINBOW	60	33
TONCI TOPIC	5	34
TONIC VENTURE	21	27
TONSONIA	27	251
TOWER BRIDGE	37	
TOYOTA MARU 15	148	
TOYOTA MARU NO 17	82	
TOYOTA MARU NO 18	66	
TRAVE ORE	70	114
TROPIC SUN	1	
TROPICAL BEAUTY	19	
TROPICALE	11	
TUNISIAN REEFER	36	
TYSON LYKES	39	
ULTRASEA	13	18
UNAMONTE	17	
UNICORN	1	233
UNITED SPIRIT	44	

SHIP NAME	VIA RADIO	VIA MAIL
USCGC ALERT (WMEC 630)	10	
USCGC BASSWOOD (WLB 38	71	74
USCGC BLACKHAW (WLB 39	7	
USCGC BOUTWELL WHEC 71	13	5
USCGC BRAMBLE (WLB 392	1	
USCGC BUTTONWOOD WLB 3	12	
USCGC CHASE (WHEC 718)	1	27
USCGC CHEROKEE WMEC 16	6	50
USCGC CHILULA (WMEC 15	23	
USCGC CLOVER (WMEC 292	3	
USCGC DEPENDABLE	1	
USCGC EAGLE (WIX 327)	2	4
USCGC GALLATIN WHEC 72	18	
USCGC GLACIER (WAGB 4)	121	
USCGC HARRIET LANE	12	
USCGC IRONWOOD (WLB 29	23	
USCGC JARVIS (WHEC 725	80	
USCGC KATMAI BAY	8	12
USCGC MACKINAW	72	105
USCGC MALLOW (WLB 396)	11	
USCGC MESQUITE (WLB 30	6	
USCGC MIDGETT (WHEC 72		60
USCGC MORGENTHAU	136	
USCGC MUNRO (WHEC 724)	1	
USCGC NORTHWIND WAGB 2	8	9
USCGC PLANETREE WLB 30	31	
USCGC POLAR SEA WAGB 1	51	
USCGC POLAR STAR WAGB	268	324
USCGC RELIANCE WMEC 61	2	
USCGC RESOLUTE WMEC 62	11	
USCGC RUSH (WHEC 723)	1	41
USCGC SEDGE (WLB 402)	9	
USCGC STORIS (WMEC 38)	20	35
USCGC SUNDEW (WLB 404)	11	14
USCGC SWEETBRIER WLB 4	53	68
USCGC TAMAROA (WMEC 16	17	31
USCGC TAMPA WMEC 902	6	
USCGC TANEY (WHEC 37)	18	25
USCGC UNIMAK (WTR 379)	23	16
USCGC UTE	9	15
USCGC VALIANT (WMEC 62	3	
USCGC VIGILANT WMEC 61	7	26
USCGC VIGOROUS WMEC 62	7	
USCGC WOODRUSH (WLB 40	13	
USCGC YOCONA (WMEC 168	173	108
USNS ALGOL	1	
USNS APACHE (T-ATF 172	7	
USNS BARTLETT(T-AGOR 1	1	88
USNS CHAUVENET	100	221
USNS DE STEIGUER	18	57
USNS GUS W. DARNELL	47	13
USNS HARKNESS (T-AGS 3	34	
USNS KAWISHIWI	19	
USNS LYNCH T-AGOR 7	34	
USNS MERCURY	48	152

SHIP NAME	VIA RADIO	VIA MAIL
USNS NARRAGANSETT	43	68
USNS NAVAJO	41	16
USNS PASSUMPSIC TAO 10		66
USNS PAWCATUCK TAO-108		128
USNS PONCHATOULA	2	
USNS POWHATAN TATF 166	13	35
USNS REDSTONE	37	
USNS SATURN T-AFS-10		103
USNS SEALIFT ANTARCTIC	21	39
USNS SEALIFT ARABIAN S	10	16
USNS SEALIFT ARCTIC	36	152
USNS SEALIFT ATLANTIC	28	
USNS SEALIFT CHINA SEA	23	41
USNS SEALIFT IND'N OCE	24	67
USNS SEALIFT MED	3	
USNS SEALIFT PACIFIC	7	16
USNS VANGUARD TAG 194	46	55
USNS WACCAMAW(TAO-109)		66
VALLEY FORGE	47	159
VAN FORT	5	
VAN TRADER	91	156
VERRAZANO BRIDGE	41	40
VICTORY ACE	34	

SHIP NAME	VIA RADIO	VIA MAIL
VISHVA PANKAJ	68	68
VISHVA PAROG	9	
VISHVA PRAFULLA	9	
VISHVA VIKRAM	7	
WASHINGTON RAINBOW #2	68	65
WELLINGTON STAR	157	
WESER EXPRESS	10	
WESTERN HIGHWAY	55	
WESTERN SUN	11	37
WESTOCEAN	420	
WESTWARD VENTURE	77	136
WESTWOOD MERCHANT		59
WESTWOOD MERIT	1	
WILFRED SYKES	90	151
WILLIAM CLAY FORD		54
WILLIAM E. MUSSMAN	35	302
WILLIAM J. DELANCEY		71
WILLOWBANK	81	
WOLVERINE		80
WORLD WING #2	104	
YAMASHIN MARU	113	37
YAQUI	15	
YOUNG SCOPE	66	

SHIP NAME	VIA RADIO	VIA MAIL
YOUNG SKIPPER	77	
YOUNG SPORTSMAN	75	113
YOUNG SPROUT	87	256
YS ARGOSY	63	45
ZAPATA ARCTIC	46	62
ZAPATA COURIER	35	
ZEELANDIA	39	
ZENIT STAR	33	176
ZENIT SUN	6	14
ZENIT WATER	120	
ZENIT WAVE	2	16
ZEUS	3	22
ZIM GENOVA	45	
ZIM HAIFA	38	
ZIM HONGKONG	22	
ZIM HOUSTON	17	
ZIM IBERIA	74	
ZIM KEELUNG	57	
ZIM MARSEILLES	20	
ZIM MIAMI	18	
ZIM NEW YORK	36	
ZIM SAVANNAH	42	
ZIM TOKYO	43	

SUMMARY: GRAND TOTAL VIA RADIO 41871
GRAND TOTAL VIA MAIL 59417
TOTAL UNIQUE OBS 82568
TOTAL DUPLICATES 18720 (22.7%)
UNIQUE RADIO OBS.23151 (28.0%)
UNIQUE MAIL OBS. 40697 (49.3%)

U.S. NDBC Climatological Data

October, November and December 1986

OCTOBER 1986

BUOY	LAT	LONG	OBS	MEAN AIR TEMP (C)	MEAN SEA TEMP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	SCALAR MEAN WIND SPEED (KNOTS)	PREVAILING WIND DIR (8 POINTS)	MAX WIND SPEED (KNOTS)	MEAN PRESSURE (MB)
32302	18.0S	085.1W	726	18.5	19.1	1.9	5.0	10.1	SE	21.4	1018.9
41001	34.9N	072.9W	742	23.0	25.5	1.9	5.5	12.0	N	26.0	1019.6
41002	32.2N	075.3W	741	24.7	27.1	1.7	4.5	11.9	NE	25.1	1019.9
41006	29.3N	077.4W	364	24.5	26.7	1.7	3.6	11.8	NE	23.6	1018.6
42001	25.9N	089.7W	741	26.4	28.6	0.9	3.1	10.2	SE	23.7	1016.8
42003	26.0N	085.9W	743	26.5	28.1	0.9	3.2	11.0	E	23.5	1017.2
42007	30.1N	088.9W	743	23.1	24.6	0.5	1.5	10.3	NE	21.3	1018.5
42009	29.3N	087.5W	725	24.6	27.7	0.8	2.6	10.4	NE	30.0	1017.9
44004	38.5N	070.6W	741	18.3	20.8	1.7	4.8	12.8	NE	25.5	1020.0
44005	42.7N	068.3W	742	11.5	12.9	1.5	4.2	12.1	SW	29.6	1017.9
44007	43.5N	070.1W	742	10.4		0.8	2.2	10.2	N	31.1	1018.8
44008	40.5N	069.5W	654	13.0	13.5	1.5	3.4	11.6	N	29.1	1019.8
44009	38.5N	074.6W	740	16.7	18.2	1.0	2.9	11.2	N	27.2	1020.5
44011	41.1N	066.6W	742	12.7	13.1	1.9	5.1	11.3	N	27.8	1018.0
44012	38.8N	074.6W	698	16.2	17.5	0.9	2.7	11.5	N	31.1	1019.7
44013	42.4N	070.8W	739	11.8	12.8	0.6	2.5	10.4	W	29.1	1018.4
45001	48.0N	087.7W	742	5.8	7.9	0.9	3.7	9.6	W	24.1	1017.7
45002	45.3N	086.4W	739	9.5	12.1	0.9	4.1	11.4	N	31.1	1018.9
45003	45.3N	082.8W	733	8.7	10.6	0.8	3.9	9.4	N	27.2	1018.5
45004	47.6N	086.5W	742	6.2	7.7	0.8	4.0	9.4	N	31.1	1018.5
45005	41.7N	082.4W	735	13.1	15.8			10.7	SW	29.1	1019.8
45006	47.3N	089.8W	740	6.9	8.2	0.8	3.9	9.3	N	31.1	1018.4
45007	42.7N	087.1W	741	12.0	14.1	0.9	3.1	11.9	S	27.2	1019.5
45008	44.3N	082.4W	741	10.4	12.5	0.8	3.8	11.5	SW	31.1	1019.2
46001	56.3N	148.3W	742	9.2	9.3			14.0	E	28.6	1004.5
46002	42.5N	130.3W	742	15.8	16.4	2.8	5.9	13.2	N	29.5	1017.3
46003	51.9N	155.9W	740	10.1	10.7	3.4	8.2	15.0	SW	37.6	1001.0
46004	50.9N	135.9W	743	13.0	13.1	2.8	6.1	12.6	SW	28.3	1012.3
46005	46.1N	131.0W	740	14.9	15.4			12.3	S	35.6	1018.0
46006	40.8N	137.6W	737	17.3	18.8	2.7	5.8	14.5	S	35.3	1017.8
46010	46.2N	124.2W	737	11.9	11.8	1.9	6.7	9.3	N	33.0	1018.6
46011	34.9N	120.9W	335	13.3	15.7	1.7	3.3	7.2	NW	19.4	
46012	37.4N	122.7W	740	13.3	14.0	1.8	4.0	6.5	NW	23.3	1016.3
46013	38.2N	123.3W	743	12.8	12.9	1.9	4.3	8.8	NW	31.5	1017.6
46014	39.2N	124.0W	739	12.4	13.1	2.1	4.5	8.1	NW	25.9	1017.4
46016	63.3N	170.3W	232	-1.0							1009.9
46022	40.8N	124.5W	740	11.9	12.0	2.3	4.9	9.0	N	28.0	1017.2
46023	34.3N	120.7W	741	15.5	16.4	2.0	4.1	12.1	NW	26.7	1016.2
46025	33.7N	119.1W	736	18.1	19.1	0.9	1.9	5.6	W	17.8	1015.0
46026	37.8N	122.7W	741	13.4	14.3	1.5	2.8	7.3	NW	23.8	1017.7
46028	35.8N	121.9W	740	14.8	15.7	2.0	4.6	9.8	NW	23.8	1017.2
46029	46.2N	124.2W	741	11.8				8.9	N	21.4	1018.4
46030	40.4N	124.5W	738	11.4	11.4			10.4	N	27.2	1017.6
46035	57.0N	177.7W	725	4.8	6.5	2.7	9.8	16.1	N	42.5	1006.4
46036	48.3N	133.9W	738	14.0	14.1	2.8	6.4	12.8	S	27.9	1015.8
46037	48.3N	133.8W	740	13.7	13.8			10.0	S	23.3	1015.4

U.S. NDBC Climatological Data cont'd

October, November and December 1986

OCTOBER 1986

BUOY	LAT	LONG	OBS	MEAN AIR TEMP (C)	MEAN SEA TEMP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	SCALAR MEAN WIND SPEED (KNOTS)	PREVAILING WIND DIR (8 POINTS)	MAX WIND SPEED (KNOTS)	MEAN PRESSURE (MB)
46038	41.9N	124.4W	739	11.2	11.3			8.6	N	27.2	1018.2
51001	23.4N	162.3W	742	26.0	26.2	2.4	6.3	11.6	E	21.0	1017.3
51002	17.2N	157.8W	741	26.9	27.5	2.2	4.3	13.7	E	20.8	1014.0
51003	19.2N	160.8W	736	26.9	28.0	2.2	4.3	10.6	NE	18.3	1014.9
51004	17.5N	152.6W	396	26.4	27.4	2.3	3.4	13.9	NE	21.6	1013.0
51005	20.4N	156.1W	738	26.0	27.4	1.6	2.9	16.2	NE	25.3	1015.9
ALRF1	24.9N	080.6W	740	26.9	28.3			11.6	E	34.1	1017.4
ALSN6	40.5N	073.8W	741	14.3	15.7			12.4	NW	34.1	1020.6
BURL1	28.9N	089.4W	738	23.5				11.2	N	30.0	1018.4
BUZM3	41.4N	071.0W	562	13.3				15.0	N	37.1	1019.6
CARO3	43.3N	124.4W	740	11.1				7.7	N	32.0	1018.8
CHLV2	36.9N	075.7W	740	18.7	19.9	1.0	3.1	13.2	N	31.0	1021.0
CLKN7	34.6N	076.5W	740	20.5				11.2	N	33.1	1020.3
CSBF1	29.7N	085.4W	737	22.5				4.6	NE	16.0	1019.1
DBLN6	42.5N	079.4W	703	11.4				9.9	S	37.1	1019.8
DESW1	47.7N	124.5W	741	11.5				7.5	SE	37.1	1018.6
DISW3	47.1N	090.7W	742	7.8				11.2	SW	37.1	1018.2
DSLN7	35.2N	075.3W	739	21.5				16.0	N	35.1	1019.2
FBIS1	32.7N	079.9W	553	19.0				8.2	NE	24.0	1020.6
FFIA2	57.3N	133.6W	740	8.4				13.3	N	34.1	1013.4
FPSN7	33.5N	077.6W	741	22.3	26.4			13.9	N	38.1	1020.0
GDIL1	29.3N	090.0W	738	23.0	24.3			8.9	NE	22.0	1018.4
GLLN6	43.9N	076.4W	731	10.6				11.9	S	35.1	1018.9
IOSN3	43.0N	070.6W	741	10.9				12.1	SW	35.1	1019.0
LKWF1	26.6N	080.0W	740	26.3	28.0			9.4	E	29.0	1018.1
MDRM1	44.0N	068.1W	741	9.7				15.1	SW	41.1	1018.0
MISM1	43.8N	068.9W	740	9.9				14.5	SW	45.1	1018.8
NWPO3	44.6N	124.1W	740	11.1				7.6	N	32.0	1018.3
PILM4	48.2N	088.4W	742	6.0				10.8	N	35.1	1017.9
PTAC1	39.0N	123.7W	742	11.8				7.2	N	24.0	1016.9
PTAT2	27.8N	097.1W	688	23.4				9.5	SE	22.0	1019.1
PTGC1	34.6N	120.7W	741	15.1				12.7	N	34.1	1015.6
ROAM4	47.9N	089.3W	739	6.6	7.8			14.0	N	43.1	1017.9
SAUF1	29.9N	081.3W	739	23.8	25.8			9.4	NE	28.0	1019.0
SBIO1	41.6N	082.8W	741	13.0				9.8	W	34.1	1019.3
SGNW3	43.8N	087.7W	727	10.2	11.5			10.6	N	27.0	1019.4
SISW1	48.3N	122.8W	711	10.4				4.5	N	33.1	1019.8
SPGF1	26.7N	079.0W	560	25.9	27.8			6.8	E	26.0	1018.4
SRST2	29.7N	094.1W	739	21.1				7.6	S	22.0	1018.1
STDM4	47.2N	087.2W	735	7.0	7.7			14.0	N	48.1	1018.0
SVLS1	32.0N	080.7W	741	22.4				12.8	NE	34.1	1019.8
TPLM2	38.9N	076.4W	742	16.1	18.4			8.5	NW	25.0	1020.7
TTIW1	48.4N	124.7W	741	10.8				10.4	E	34.1	1019.1
VENF1	27.1N	082.5W	739	24.1	27.7			6.2	NE	19.0	1018.0
WPOW1	47.7N	122.4W	736	11.4				5.5	N	22.0	1019.9

U.S. NDBC Climatological Data cont'd

October, November and December 1986

NOVEMBER 1986

BUOY	LAT	LONG	OBS	MEAN AIR TEMP (C)	MEAN SEA TEMP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	SCALAR MEAN WIND SPEED (KNOTS)	PREVAILING WIND DIR (8 POINTS)	MAX WIND SPEED (KNOTS)	MEAN PRESSURE (MB)
32302	18.0S	085.1W	717	19.1	19.4	1.7	3.2	10.1	SE	19.4	1016.8
41001	34.9N	072.9W	717	21.0	23.9	1.9	4.5	11.9	NE	26.6	1021.5
41002	32.2N	075.3W	719	23.3	25.8	1.8	4.1	11.4	S	28.2	1021.1
41006	29.3N	077.4W	719	24.9	26.2	1.6	4.2	10.2	E	25.7	1019.0
42001	25.9N	089.7W	719	25.9	27.3	1.3	4.1	12.0	SE	26.2	1015.7
42002	26.0N	093.5W	626	24.4	26.6	1.4	3.7	14.8	S	28.6	1015.8
42003	26.0N	085.9W	719	26.0	26.9			12.0	E	23.8	1017.0
42007	30.1N	088.9W	710	18.9	20.0	0.6	1.8	11.8	NE	27.2	1016.7
42009	29.3N	087.5W	702	22.9	25.2	0.9	2.8	12.9	SE	33.1	1017.3
44004	38.5N	070.6W	719	15.0	19.0	1.9	6.3	12.9	NE	32.2	1022.1
44005	42.7N	068.3W	717	7.3	10.1	1.9	6.5	14.2	SW	32.1	1020.4
44007	43.5N	070.1W	717	5.0		1.0	4.3	13.7	SW	27.2	1021.2
44008	40.5N	069.5W	717	9.6	12.3	1.7	6.4	14.4	N	50.5	1020.7
44009	38.5N	074.6W	712	11.5	14.9	1.1	2.8	12.2	N	35.0	1022.6
44011	41.1N	066.6W	718	9.4	10.9	2.1	7.7	12.3	NW	37.0	1020.5
44012	38.8N	074.6W	719	10.9	14.4	1.0	2.6	12.4	N	35.0	1021.5
44013	42.4N	070.8W	717	6.3	9.6	9.7	3.5	12.6	W	35.0	1020.6
45001	48.0N	087.7W	717	-1.5	7.0	1.4	5.7	13.3	NW	29.6	1016.4
45002	45.3N	086.4W	143	5.0	9.6	1.1	2.9	12.8	N	23.3	1022.1
45003	45.3N	082.8W	695	2.3	6.7	1.3	4.0	14.3	SW	27.2	1019.1
45004	47.6N	086.5W	430	-0.5	5.0	1.7	5.2	15.4	NW	31.1	1017.9
45005	41.7N	082.4W	553	5.6	9.7			12.1	SW	25.3	1021.8
45006	47.3N	089.8W	477	-1.4	5.1	1.4	5.0	15.6	SW	36.9	1018.2
45007	42.7N	087.1W	471	4.0	9.8	1.2	3.2	14.4	SW	29.1	1022.2
45008	44.3N	082.4W	715	3.5	8.1	1.2	3.4	15.3	SW	33.0	
46001	56.3N	148.3W	694	6.5	8.4			16.2	SW	38.0	1002.8
46002	42.5N	130.3W	516	14.9	15.7	2.5	9.0	12.7	SE	21.7	1022.7
46003	51.9N	155.9W	706	7.1	8.5	3.8	9.9	17.5	W	36.9	1004.7
46004	50.9N	135.9W	706	10.6	11.4	4.1	14.1	16.7	W	36.5	1012.0
46005	46.1N	131.0W	694	12.9	14.0			13.7	W	33.5	1020.5
46006	40.9N	137.6W	694	15.7	17.1	3.1	7.7	15.4	W	31.2	1025.6
46010	46.2N	124.2W	658	10.2	10.7	2.7	8.3	12.7	S	36.9	1020.2
46012	37.4N	122.7W	703	12.6	12.6	2.0	4.3	7.8	NW	23.3	1019.7
46013	38.2N	123.3W	691	12.5	12.1	2.2	5.4	10.5	NW	32.3	1021.2
46014	39.2N	124.0W	700	12.4	12.8	2.6	6.9	8.1	NW	29.3	1021.4
46016	63.3N	170.3W	239	-3.9							1006.7
46022	40.8N	124.5W	149	13.7	13.3	2.7	4.6	10.8	N	30.6	1021.1
46023	34.3N	120.7W	695	15.5	15.8	2.4	6.0	13.3	NW	29.3	1017.6
46025	33.7N	119.1W	700	17.9	19.2	0.7	1.9	6.2	NW	24.7	1017.0
46026	37.8N	122.7W	702	12.8	12.6	1.6	3.5	8.1	NW	24.6	1021.0
46027	41.8N	124.4W	617	11.2	11.2	2.4	5.9	11.7	N	42.7	1021.6
46028	35.8N	121.9W	695	14.3	14.6	2.4	5.2	10.8	NW	26.8	1019.9
46029	46.2N	124.2W	691	10.1							1020.3
46030	40.4N	124.5W	402	11.6	11.1			10.3	N	29.1	1021.2
46035	57.0N	177.7W	698	3.4	5.1	2.8	8.4	15.9	NE	38.0	1000.9
46036	48.3N	133.9W	626	12.0	12.9	3.8	14.3	14.6	W	40.0	1017.3

U.S. NDBC Climatological Data cont'd

October, November and December 1986

NOVEMBER 1986 BUOY	LAT	LONG	OBS	MEAN AIR TEMP (C)	MEAN SEA TEMP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	SCALAR MEAN WIND SPEED (KNOTS)	PREVAILING WIND DIR (8 POINTS)	MAX WIND SPEED (KNOTS)	MEAN PRESSURE (MB)
46037	48.3N	133.8W	697	11.5	12.4			22.6	W	36.9	1016.7
46038	41.9N	124.4W	693	11.4	11.4			10.3	N	36.9	1022.5
51001	23.4N	162.3W	694	24.7	24.4	3.0	5.5	13.4	E	24.9	1016.1
51002	17.2N	157.8W	705	26.3	27.0	2.9	4.8	16.0	E	26.5	1012.2
51003	19.2N	160.8W	695	26.3	27.4	2.7	5.1				1012.9
51005	20.4N	156.1W	693	25.3	26.6	2.3	3.9	19.8	NE	31.1	1012.6
ALRF1	24.9N	080.6W	695	26.4	27.1			12.9	NW	26.0	1018.0
ALSN6	40.5N	073.8W	719	8.3	11.7			12.7	N	35.1	1022.8
BURL1	28.9N	089.4W	701	20.4				13.6	N	35.1	1017.9
BUZM3	41.4N	071.0W	716	7.9				15.9	SW	52.1	1022.0
CARO3	43.3N	124.4W	693	10.9				11.2	S	32.0	1022.4
CHLV2	36.9N	075.7W	719	13.2	15.5	1.0	2.3	13.5	N	39.1	1022.9
CLKN7	34.6N	076.5W	718	16.5				11.8	NE	26.0	1021.6
CSBF1	29.7N	085.4W	706	20.5				4.9	E	16.0	1018.7
DBLN6	42.5N	079.4W	682	4.9				11.0	S	42.1	1021.4
DESW1	47.7N	124.5W	692	8.9				11.6	SE	39.1	1019.1
DISW3	47.1N	090.7W	716	-0.8				15.4	W	42.1	1017.1
DSLN7	35.2N	075.3W	719	18.7	23.5			17.2	N	40.1	1020.6
FBIS1	32.7N	079.9W	719	16.9				7.7	NE	26.0	1020.0
FFIA2	57.3N	133.6W	693	3.0				14.4	N	41.1	1010.7
FPSN7	33.5N	077.6W	717	19.9	24.2			15.5	N	39.1	1020.6
GDIL1	29.3N	090.0W	704	20.1	21.1			10.7	NE	30.0	1017.7
GLLN6	43.9N	076.4W	692	4.4				16.1	S	37.1	1020.6
IOSN3	43.0N	070.6W	716	5.4				14.4	NW	37.1	1021.2
LKWF1	26.6N	080.0W	717	25.8	26.7			10.5	E	28.0	1018.9
MDRM1	44.0N	068.1W	717	4.8				18.7	NW	43.1	1020.3
MISM1	43.8N	068.9W	716	5.0				18.5	NW	56.1	1021.2
NWPO3	44.6N	124.1W	694	10.0				11.1	E	39.1	1021.3
PILM4	48.2N	088.4W	719	-1.9				15.7	W	45.1	1016.5
PTAC1	39.0N	123.7W	710	11.0				7.5	N	27.0	1020.7
PTAT2	27.8N	097.1W	692	17.9				10.4	N	35.1	1017.6
PTGC1	34.6N	120.7W	696	15.3				13.3	N	41.1	1017.6
ROAM4	47.9N	089.3W	717	-1.2	5.4			18.1	N	53.1	1016.5
SAUF1	29.9N	081.3W	567	21.2	22.3			8.0	N	28.0	1018.7
SBIO1	41.6N	082.8W	719	4.8				10.9	SW	30.0	1021.4
SGNW3	43.8N	087.7W	635	1.4	5.5			12.2	SW	30.0	1019.7
SISW1	48.3N	122.8W	668	7.7				11.1	SE	42.1	1017.6
SPGF1	26.7N	079.0W	716	25.6	27.2			7.4	E	26.0	1019.6
SRST2	29.7N	094.1W	713	17.0				7.7	N	22.0	1017.7
STDM4	47.2N	087.2W	716		5.3			18.7	W	46.1	1016.7
SVLS1	32.0N	080.7W	716	18.6				12.6	NE	34.1	1020.2
TPLM2	38.9N	076.4W	717	8.4	11.5			8.6	N	31.0	1022.9
TTIW1	48.4N	124.7W	713	8.3				16.1	E	48.1	1018.7
VENF1	27.1N	082.5W	689	23.6	25.3			6.1	E	18.0	1018.5
WPOW1	47.7N	122.4W	693	8.0				8.7	S	28.0	1020.5

U.S. NDBC Climatological Data cont'd

October, November and December 1986

DECEMBER 1986

BUOY	LAT	LONG	OBS	MEAN AIR TEMP (C)	MEAN SEA TEMP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	SCALAR MEAN WIND SPEED (KNOTS)	PREVAILING WIND DIR (8 POINTS)	MAX WIND SPEED (KNOTS)	MEAN PRESSURE (MB)
32302	18.0S	085.1W	745	20.2	20.7	1.6	2.5	8.6	SW	17.5	1015.4
41001	34.9N	072.9W	742	17.5	21.8	2.3	5.6	12.9	N	28.2	1021.1
41002	32.2N	075.3W	743	20.1	24.0	2.3	6.4	13.5	E	30.8	1020.5
41006	29.3N	077.4W	744	22.6	24.8	2.0	4.2	12.1	E	27.5	1018.7
42001	25.9N	089.7W	743	22.5	26.2	1.5	3.6	13.4	NE	30.8	1017.4
42002	26.0N	093.5W	743	21.3	24.9	1.6	4.2	15.3	NE	33.4	1018.2
42003	26.0N	085.9W	743	22.6	25.1			13.1	NE	31.1	1018.1
42007	30.1N	088.9W	432	13.7	16.3	0.7	1.3	12.3	NE	23.5	1021.0
42009	29.3N	087.5W	736	18.0	23.4			13.7	NE	35.3	1019.3
44004	38.5N	070.6W	744	11.2	16.9	2.5	10.1	13.2	NW	34.9	1021.3
44005	42.7N	068.3W	743	4.1	8.1	2.3	6.9	15.7	NW	33.9	1020.0
44007	43.5N	070.1W	739	1.5	6.4	1.2	6.0	12.5	W	29.1	1021.3
44008	40.5N	069.5W	491	5.4	9.7	2.2	6.7	16.4	N	48.6	1019.3
44009	38.5N	074.6W	744	7.2	10.7	1.4	4.7	13.6	N	33.0	1022.5
44011	41.1N	066.6W	742	6.1	8.7	2.6	8.1	14.8	NW	36.2	1019.5
44012	38.8N	074.6W	739	6.9	10.2	1.3	5.2	14.1	N	35.0	1021.3
44013	42.4N	070.8W	743	2.7	6.6	1.0	5.0	13.7	W	42.7	1020.4
45001	48.0N	087.7W	743	-2.3	8.2	1.3	4.0	13.3	W	28.3	1016.9
45003	45.3N	082.8W	098	1.1	4.9	2.0	3.0	18.2	W	27.2	1017.8
45008	44.3N	082.4W	120	1.2	5.9	1.8	3.0	20.3	W	29.1	
46001	56.3N	148.3W	742	5.8	6.5	4.2	6.6	16.8	SE	32.6	994.8
46003	51.9N	155.9W	743	5.2	5.8	4.6	10.3	18.4	SW	37.3	989.4
46004	50.9N	135.9W	743	9.0	9.3	4.3	10.2	16.5	SE	35.7	1007.8
46005	46.1N	131.0W	741	11.2	12.2	4.4	8.1	14.3	S	30.8	1013.7
46006	40.8N	137.6W	740	13.4	15.0	4.4	10.0	19.6	SW	39.7	1014.0
46012	37.4N	122.7W	743	12.4	13.5	2.4	5.0	6.3	N	21.4	1020.1
46013	38.2N	123.3W	742	11.1	12.7	2.5	5.8	9.6	E	25.3	1020.6
46014	39.2N	124.0W	741	11.7	12.9	3.0	6.1	8.2	SE	26.9	1019.9
46016	63.3N	170.3W	241	-9.7							992.7
46023	34.3N	120.7W	741	14.6	15.9	2.7	5.4	10.8	NW	25.6	1018.5
46025	33.7N	119.1W	742	16.3	17.2	1.0	2.0	5.8	NW	18.9	1018.3
46026	37.8N	122.7W	741	10.9	12.3	2.1	4.7	8.9	NE	20.2	1020.2
46027	41.8N	124.4W	137	10.4	11.0	2.6	4.2	10.1	N	31.1	1016.0
46028	35.8N	121.9W	744	14.1	15.0	2.7	6.2	8.4	NW	24.4	1020.1
46029	46.2N	124.2W	740	8.6		2.7	5.7				1018.0
46035	57.0N	177.7W	744	1.3	3.8	4.1	8.8	18.7	NE	37.2	980.9
46037	48.3N	133.8W	740	9.7	10.1						1010.7
46038	41.9N	124.4W	742	10.8	11.4						1019.6
46039	48.2N	123.4W	364	7.5	8.1						1015.3
51001	23.4N	162.3W	742	23.1	22.7	3.0	6.0	10.4	E	26.2	1018.0
51002	17.2N	157.8W	744	25.1	25.9	2.8	4.8	15.5	E	23.9	1014.4
51003	19.2N	160.8W	741	25.2	26.4	2.8	4.9	11.1	NE	22.1	1015.2
51005	20.4N	156.1W	745	24.1	25.3	1.7	3.1	15.9	NE	29.1	
ALRF1	24.9N	080.6W	739	23.8	25.5			13.1	N	33.1	1018.1
ALSN6	40.5N	073.8W	744	4.6	8.3			15.5	N	46.1	1022.5
BURL1	28.9N	089.4W	741	13.4				14.1	N	32.0	1020.0

U.S. NDBC Climatological Data cont'd

October, November and December 1986

DECEMBER 1986

BUOY	LAT	LONG	OBS	MEAN AIR TEMP (C)	MEAN SEA TEMP (C)	MEAN WAVE HT (M)	MAX WAVE HT (M)	SCALAR MEAN WIND SPEED (KNOTS)	PREVAILING WIND DIR (8 POINTS)	MAX WIND SPEED (KNOTS)	MEAN PRESSURE (MB)
BUZM3	41.4N	071.0W	744	4.0				17.7	NW	48.1	1021.7
CARO3	43.3N	124.4W	740	9.3				8.4	SE	36.1	1018.9
CHLV2	36.9N	075.7W	743	8.5	10.7	1.2	4.2	14.4	N	43.1	1023.0
CLKN7	34.6N	076.5W	729	10.6				12.1	N	37.1	1020.0
CSBF1	29.7N	085.4W	741	14.1				5.1	N	22.0	1020.0
DBLN6	42.5N	079.4W	713	1.1				12.4	SW	42.1	1021.5
DESW1	47.7N	124.5W	741	7.7				13.1	SE	36.1	1017.6
DISW3	47.1N	090.7W	744	-3.3				13.3	SW	35.1	1018.1
DSLN7	35.2N	075.3W	744	13.3	20.7			18.5	N	56.1	1020.6
FBIS1	32.7N	079.9W	744	11.2				8.1	NE	31.0	1020.7
FFIA2	57.3N	133.6W	740	4.4				12.5	SE	40.1	1010.5
FPSN7	33.5N	077.6W	742	15.4	22.7			16.4	N	43.1	1021.0
GDIL1	29.3N	090.0W	740	13.0	14.9			10.5	NE	32.0	1020.1
GLLN6	43.9N	076.4W	699	0.8				14.9	W	41.1	1020.8
IOSN3	43.0N	070.6W	641	1.9				15.3	NW	45.1	1021.3
LKWF1	26.6N	080.0W	744	22.6	24.9			10.4	NW	28.0	1019.2
MDRM1	44.0N	068.1W	743	1.4				20.0	NW	50.1	1020.2
MISM1	43.8N	068.9W	744	1.4				19.7	NW	53.1	1021.3
NWPO3	44.6N	124.1W	742	8.2				9.6	E	35.1	1018.4
PILM4	48.2N	088.4W	744	-2.9				14.7	SW	38.1	1017.0
PTAC1	39.0N	123.7W	743	9.9				6.8	SE	31.0	1019.4
PTAT2	27.8N	097.1W	738	13.3				10.8	N	32.0	1020.5
PTGC1	34.6N	120.7W	742	14.0				9.7	N	29.0	1018.6
ROAM4	47.9N	089.3W	744	-2.6	3.9			17.1	SW	42.1	1017.2
SAUF1	29.9N	081.3W	735	16.3	17.7			10.4	N	28.0	1019.9
SBIO1	41.6N	082.8W	743	0.4				11.1	W	29.0	1021.7
SBNW3	43.8N	087.7W	512	-2.7	0.9			9.7	SW	29.0	1020.9
SISW1	48.3N	122.8W	718	6.9				12.2	SE	37.1	1017.1
SPGF1	26.7N	079.0W	741	23.4	25.5			7.6	E	23.0	1019.5
SRST2	29.7N	094.1W	739	10.6				6.6	N	21.0	1020.8
STDM4	47.2N	087.2W	744	-1.7				17.7	W	38.1	1017.2
SVLS1	32.0N	080.7W	743	12.8				14.8	NE	41.1	1021.0
TPLM2	38.9N	076.4W	744	4.7	6.2			8.8	NW	29.0	1022.9
TTIW1	48.4N	124.7W	740	7.7				17.9	E	43.1	1017.8
VENF1	27.1N	082.5W	738	19.5	21.9			7.6	NE	23.0	1018.9
WPOW1	47.7N	122.4W	741	6.6				7.3	N	25.0	1020.3

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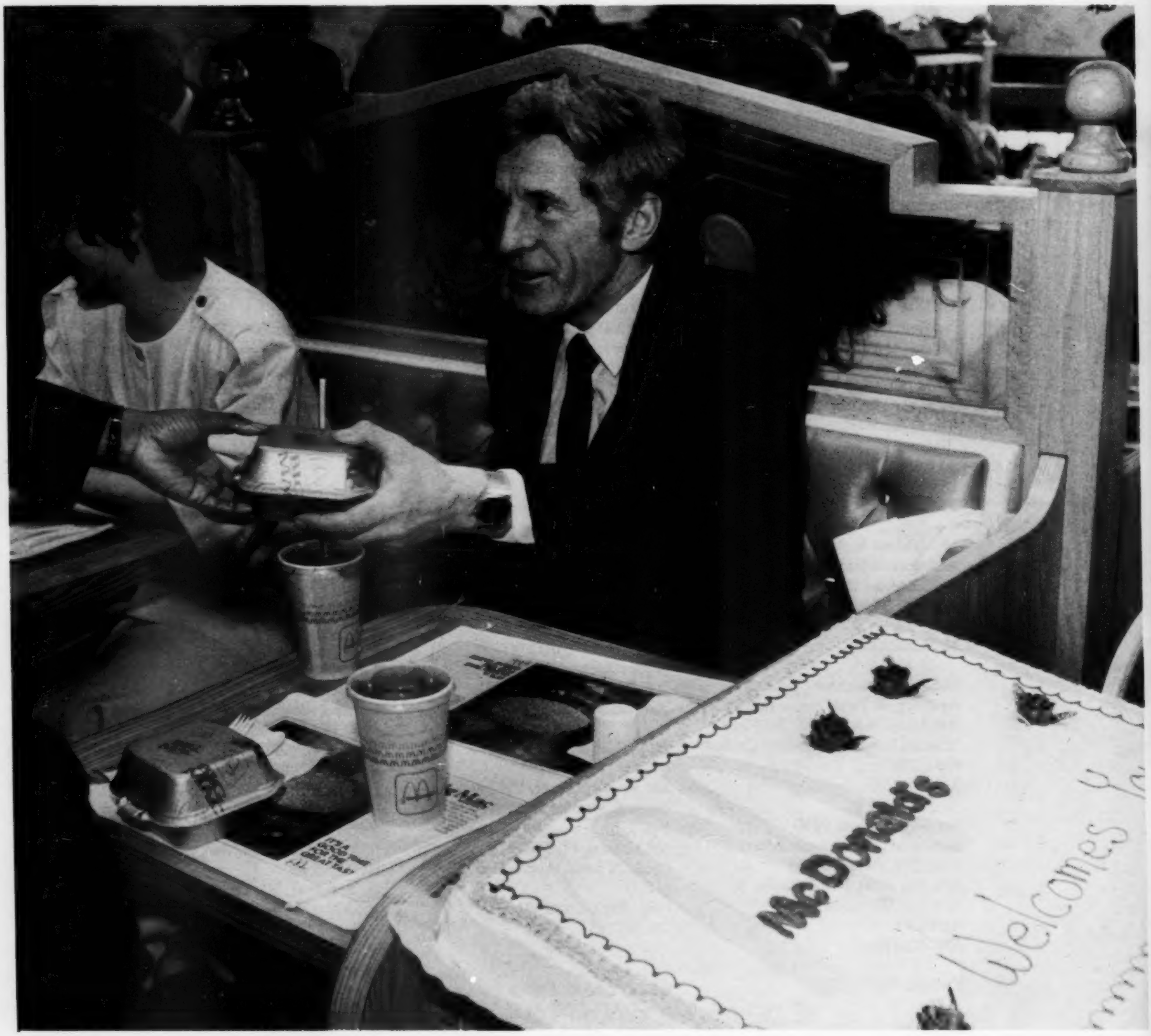

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